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Developing Air Tanker Performance Guidelines

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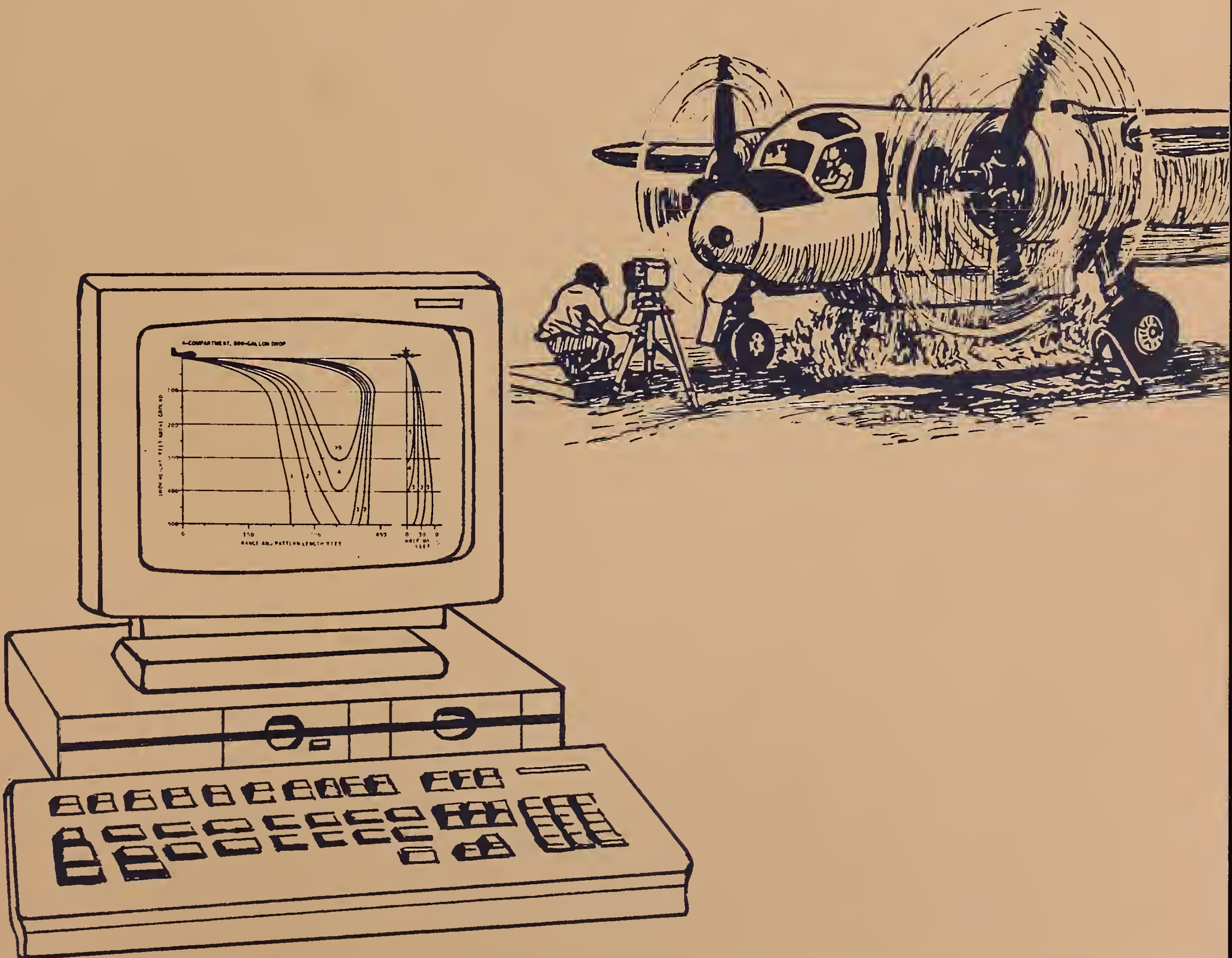

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INTRODUCTION

Since the first operational airtanker drops in 1956, many different aircraft, ranging from agricultural spray planes to modern military transports, have been used as airtankers. The tank and gating systems of these aircraft are of many different designs, with differing capabilities. In 1969, the Forest Service initiated research studies to quantify the capabilities of different tank and gating systems. The studies entailed the dropping of retardant and/or water over a sampling grid and determining the ground pattern under a variety of conditions: tank configuration, door sequencing speed, drop height, retardant type, relative humidity, temperature, windspeed, and direction (George 1975; George and Blakely 1973). Using these data, Honeywell Corporation, under contract to the Forest Service, developed a pattern simulation model whose primary variable was the flow history from the individual systems (Swanson and others 1975). The rough model used flow history derived from motion pictures of airborne airtanker drops. The model was refined through the use of accurately measured flow data. (Swanson and others 1977). A BASIC listing of the model is included as appendix A.

Information from the refined model (PATSIM) suggested that proper tank design could be used to produce drop patterns that would be effective for nearly any fuel-fire condition. In order to define the tank parameters and to fine-tune and validate PATSIM, an experimental tank and gating system (ETAGS) was designed, installed in a Forest Service P2V-5 airtanker, and drop-tested over a sampling grid. The ETAGS was designed so that tank and gating parameters, including load size, fluid head height, door opening length-to-width ratio, compartment separation, door-opening area, and fluid flow rates could be examined along with flight parameters (drop height and speed). The knowledge gained from the ETAGS test was used to refine PATSIM to its final form. The accuracy of PATSIM was proven for tanks with "average" length-to-width ratios; however, for tanks with an extreme length-to-width ratio PATSIM showed a strong tendency to underpredict the length of the ground pattern and overpredict the retardant coverage concentrations (Swanson and others 1978).

About 90 percent of the current airtankers have been static-tested and user guidelines produced. New airtankers are tested as part of Interagency Airtanker Board (IATB) approval process. PATSIM is also used as a tool to aid in the design of new tank and gating systems and for evaluating flow-rate modifications to enable airtankers to meet improved and more flexible standards set by the IATB (USDA FS 1987).

GUIDELINE DEVELOPMENT SEQUENCE

The first step in the generation of airtanker performance guidelines is to quantify the flow of water/retardant from the airtanker delivery system for all possible drop configurations. This is accomplished by static testing airtankers to determine flow history, door-opening rate, and internal tank pressure according to the methods set forth by Blakely, George, and Johnson (1982). The representative flow rates for each compartment and drop type are selected and used as input to PATSIM (the airtanker ground pattern response model) and PATADD (adjunct to PATSIM for reducing data from dissimilar compartments in a tanking system). The ground pattern data output by PATSIM/PATADD is smoothed, tabulated, plotted (using computer programs developed at the Intermountain Fire Sciences Laboratory and written in BASIC), and assembled into a standard guideline format. A schematic of the steps followed in producing airtanker performance guidelines is shown in figure 1.

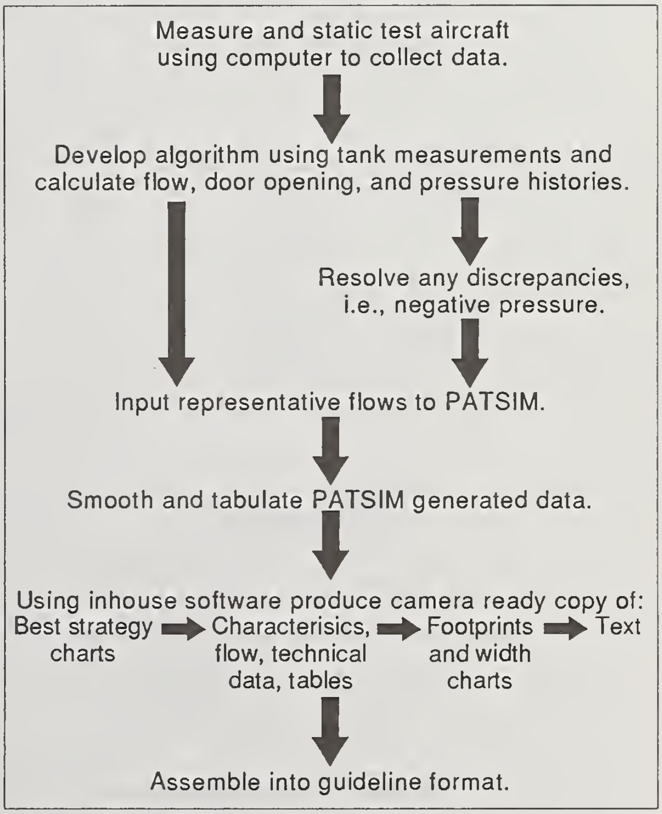


Figure 1—Guideline production sequence.

OPERATION OF PATSIM/PATADD MODELS

The simulation program (PATSIM) uses an algorithm consisting of four distinct parts:

1. Generation of a marginal downrange distribution (percent of retardant delivered in each foot of pattern length) from flow rate and aircraft velocity.
2. Development of the marginal crossrange distribution as a function of altitude and retardant type.
3. Calculation of the ground response pattern from the distributions.
4. Summarization of the ground response pattern as a scaled pattern schematic of the coverage level distribution on the ground and the gallons, area, and lengths associated with various coverage levels.

The generation of the marginal range distribution, though empirically derived, has its analogy in the physical process of the breakup of the mass of retardant released from an airtanker (fig. 2). The door opening shapes the emerging fluid (phase A), which is subject to small particle stripping, drag deceleration, and amplifying instabilities of two types—Taylor instabilities on the front surface and Helmholtz instabilities on the side surfaces. The small particles stripped from the retardant are a relatively insignificant portion of the total mass. The emerging liquid mass also expands to the sides and becomes shorter as lateral flow replaces some of the deceleration (phase B). The amplitude of the Taylor instabilities increases until air pressure on the front surface causes breakup and final particle size distribution (phases C and D). Rheological properties and airspeed establish the time to breakup and final particle size.

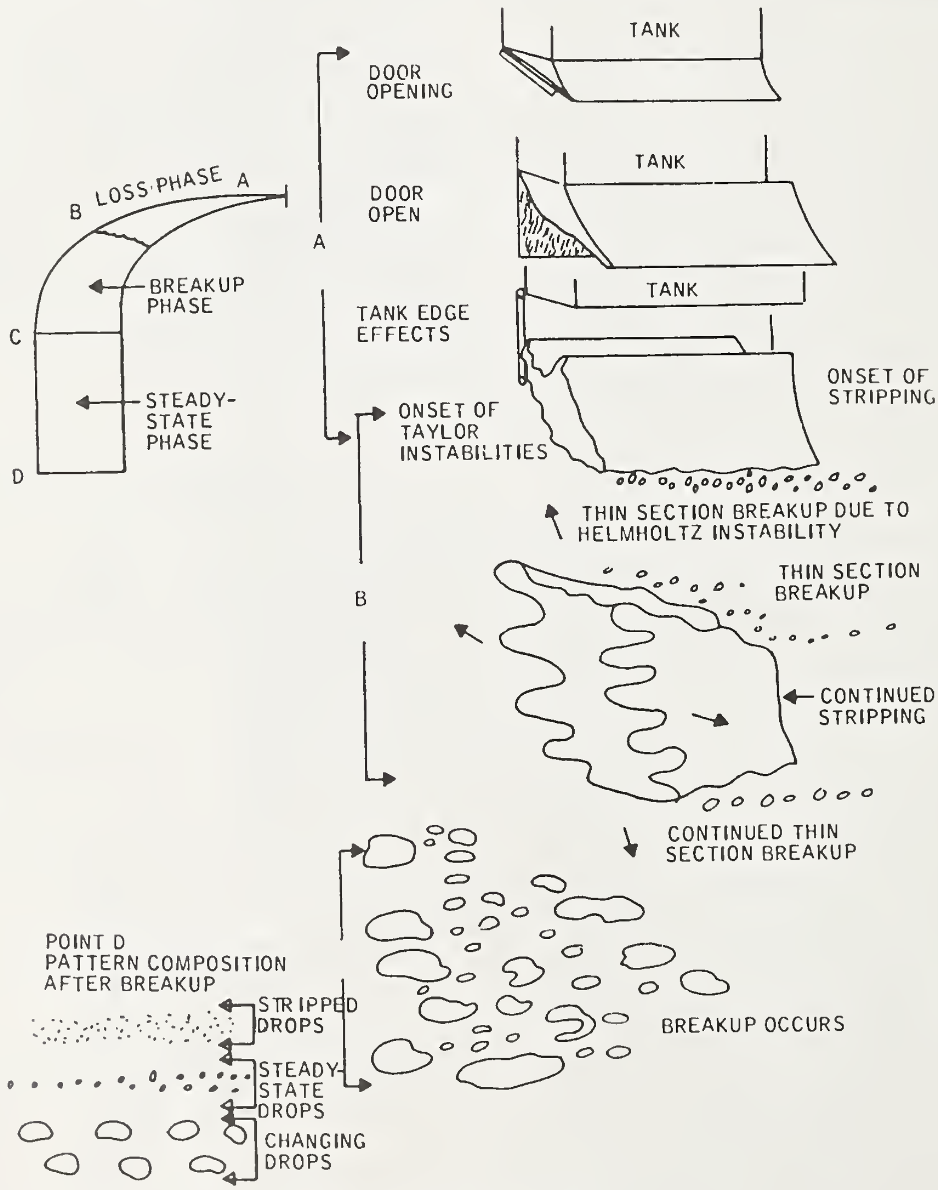


Figure 2—Schematic representation of the breakup process.

In the case of one or more compartments located aft of, and released at the same time as, a front compartment, the forward released retardant acts as a wind shield for the aft releases, thereby delaying the breakup until the forward release is nearly at its final particle size. At that point, the aft release passes through the retardant cloud of the forward release.

The algorithm first calculates the range marginal distribution by breaking the volume discharged from the tank into small increments based on time and calculating each one's distribution at the ground level. The distributions are summed to produce the final range marginal distribution.

To develop the range marginal distribution into an isopleth, a normal crossrange marginal is assumed and is calculated on the basis of altitude and retardant type. An amount of retardant lost to evaporation and small particle drift is discarded. A percentage of the remaining retardant (also a function of altitude and retardant type) is distributed over an elliptical area. This quantity represents the fringe of the pattern, contains low coverage levels, and is most subject to wind drift. The remaining 70-90 percent of the retardant is distributed as a normal distribution. The sum of these two sections produces the simulated ground pattern (fig. 3).

In order to calculate the most efficient time interval between single tank releases that make up a trail drop, a subroutine (PATADD) is used. PATADD shifts and overlays the simulated patterns, determining the time interval between door releases for each coverage level that produces the longest length of retardant pattern for that coverage level.

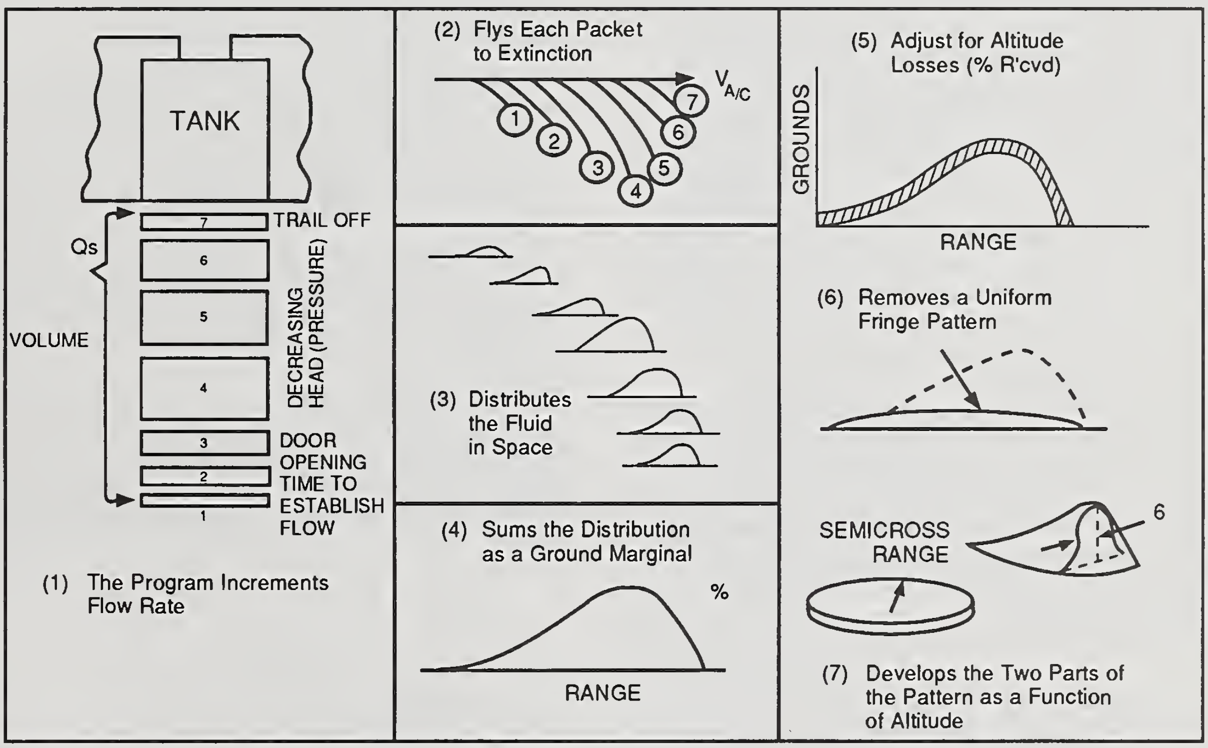


Figure 3—Simulation overview (Swanson and others 1975).

Inputs to PATSIM Model

The simulation is designed to be used in two general modes: (1) the tank is described geometrically and the flow rate calculated and (2) the flow rate is determined experimentally and input directly to the simulation. The latter has proven to be the most accurate and is used to produce the guidelines. Experience has shown that door-opening rate (which is reflected in the flow rate) and ejection velocity from the tank have little effect on the accuracy of the prediction and are therefore not used.

The inputs used in PATSIM for guideline production are: (1) experimental tank flow data; (2) quantity vs. time; (3) number of flow data entries; (4) total gallons in tank; (5) number of tanks released; (6) retardant type; (7) aircraft speed; (8) aircraft altitude; (9) ADD, a flag set if trail drops are to be calculated using the PATADD subroutine (table 1). A sample input is contained in appendix B.

PATSIM Modification

The PATSIM predicts ground response patterns satisfactorily for most airtankers in use. But the ETAGS study showed that modifications to PATSIM were necessary for a tank with very clean exit geometry. One particular tank, installed in a Conair Aviation, Ltd., DC-6, had compartments that were smooth, with no reinforcing members or door edges that could cause turbulence in the exiting retardant. Using data for actual ground response obtained over a test grid, it was found that an erosion constant K1 and a shape factor DELZ need adjustment to correctly predict the down range marginal. Similarly, SIGMA, the shape factor for the normal distribution in the cross range marginal also needed adjustment.

After using various values for these constants and comparing the results from PATSIM with the actual pattern responses from drop tests, it was found that the three constants worked best for generally smooth tanks when converted to variables that were a function of drop height and the number of compartments dropped. Only one such tank has been tested. PATSIM was developed from ground response data for tanks that would impart turbulence to the exiting retardant due to internal bracing, door sills, and other features.

Program Output

The program output consists of (1) a report of input data; (2) detailed pattern plot; (3) contour interval summaries; (4) a scaled pattern plot; (5) pattern length data; and (6) PATADD output, if selected. A sample output is shown in appendix B.

INPUT DATA

An echo of input data for confirmation of data and identification of the pattern.

DETAILED PATTERN PLOT

A printout of the pattern on a 28-column by 56-row unscaled array. The distance between columns is 15 feet and between rows is 30 feet.

CONTOUR INTERVAL SUMMARIES

1. Table of the amounts of retardant in each coverage level (gallons per 100 square feet) 0.0-0.5, 0.6-1.0, 1.1-2.0, 2.1-3.0, 3.1-4.0, 4.1-5.0, 5.1-6.0, 6.1-7.0, 7.1-8.0, 8.1-9.0, 9.1-10.0, and greater than 10 gallons.
2. Total amount of retardant on the grid in gallons and the percent of total gallons dropped that is recovered.
3. The area in square feet covered tabulated by the coverage levels and the total area covered.
4. A scaled pattern schematic with listed coverage levels and a table of pattern lengths tabulated by coverage levels.
5. If the PATADD option was selected, a table of the maximum length of the patterns for multiple tank drops and the delay between releases required to obtain the patterns at coverage levels equal to or greater than 0.5, 1.0, 2.0, 3.0, 4.0, 6.0, 8.0, 10.0 gallons per 100 square feet (gpc).

Table 1—PATSIM inputs

Variable No.	Name	Description
17	GALI	Total volume of tank in gallons
18	CFLAG	Number of tanks released
24	RDQV	Flag to select option for entry of experimental flow data also the number of entries in the flow data table
45	RFLAG	Retardant type—1 = gum-thickened; 2 = waterlike
51	VACI	Aircraft speed
2	ALT	Aircraft altitude
53	ADD	Flag to select PATADD
*	*	A code in columns 1–8 indicating the number of patterns to add

GUIDELINE PRODUCTION

Selection of Inputs

The basic input will be the volume discharged as a function of time (flow) for *each compartment of the tank system to be analyzed.* For example, a six-tank system might have its six compartments in a row across the tank, with the two outside tanks differing from the four inner tanks (fig. 4). Flows from the outer and inner tanks would be expected to differ even though their volumes are nearly identical. It is also possible that due to capacities of hydraulic or pneumatic door-opening systems the doors of some compartments may open at different rates than others. This produces different flows from the same compartment when the compartment is released alone or in conjunction with one or more other compartments. The static test data (flow rates, door-opening time, and tank pressure) should include tests of all geometrically dissimilar tanks under all possible release conditions. In the case of the tank in figure 5, if each compartment opened at the same rate for 1, 2, 3, or 6 compartments released at a time, two different flows (outer and inner compartments) would be needed to characterize the tank. If the flows had been different for one compartment at a time and six compartments at a time, four different flows would be required. The best method of comparing flows is to plot volume discharged vs. time from static tests for any compartments that could be different (fig. 5). In cases where a difference is not obvious, PATSIM can be applied using the flow data to be compared as inputs to determine if pattern differences exist.

In the case of inadequate venting of a compartment, the flow may appear to halt or slow momentarily before continuing. Because flow measurements are taken by use of a float on the surface of the liquid, it would appear that the flow out of the tank was halted. But, examination of high-speed films and testing with a transparent tube showed that the tank was still emptying from the bottom. In this case, the flow must be synthesized. The best approximation of flow is to extrapolate the volume discharged to an end point where the float begins to free-fall (fig. 5). With undervented tanks, the flow and thus the ground pattern can exhibit undesirable effects such as thinning or gaps in coverage. Whenever possible, adjustable venting systems are used and venting is fixed after optimum flow rate is attained. When venting adjustments cannot be adjusted at the time of the test, vent size is set on the basis of experience.

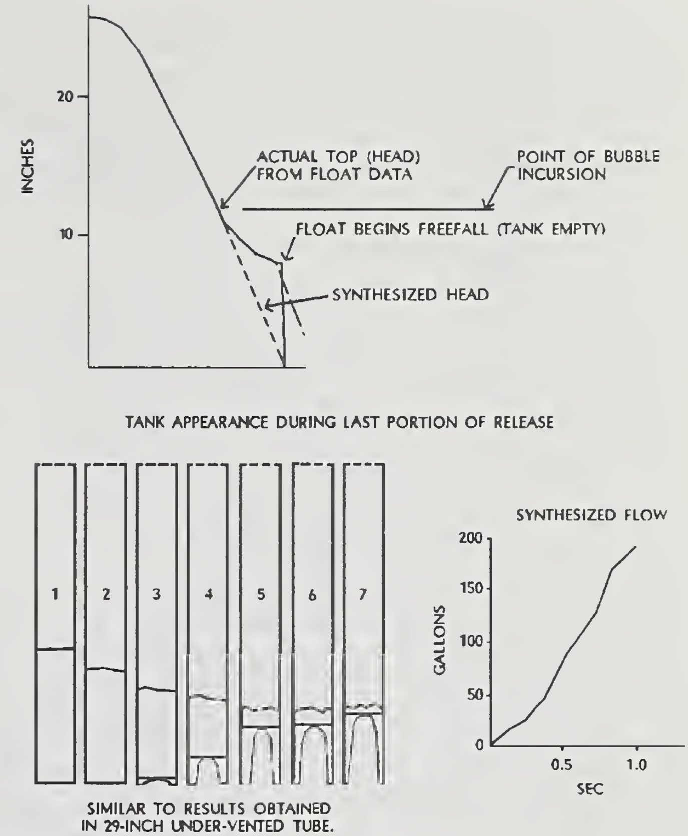


Figure 5—Method of inferring final stages of flow from an undervented tank.

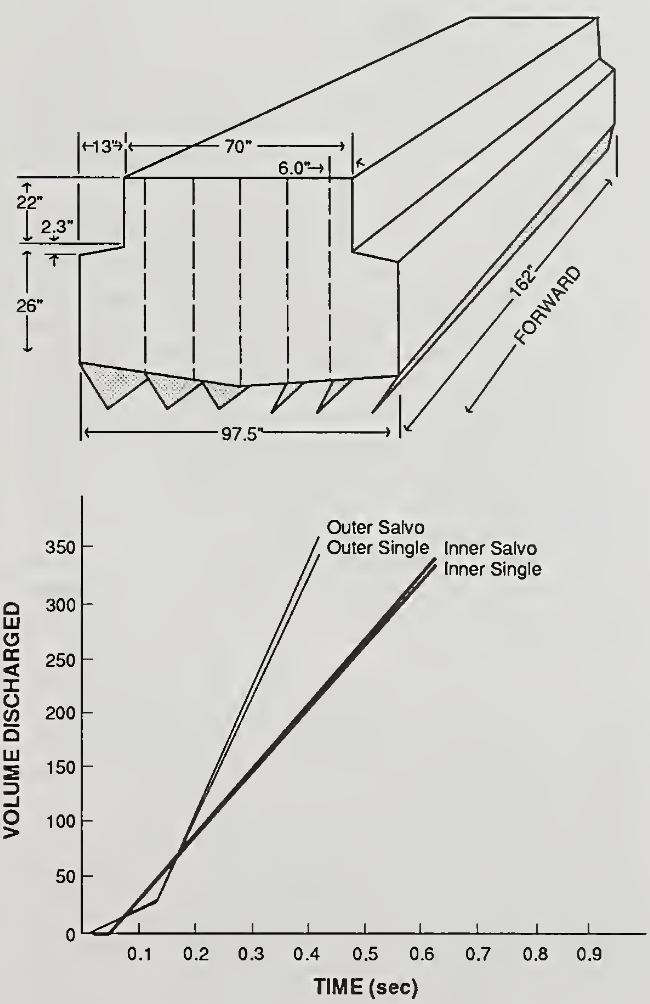


Figure 4—P2V–7 tank and flow rates.

After evaluation of the flow data, typical flows are selected for use in the computer simulation of drop patterns. If there is a large amount of variation in flows within replicate static tests, a mean flow should be selected. But the extremes of flow data should also be evaluated using the simulation to assess the sensitivity of these variations on guideline conclusions. In most cases, these variations are minor.

The computer simulations are run at a midrange aircraft velocity taken from the velocities listed in the approved supplemental flight certificate when used as an airtanker. This range is typically narrow (110-135kt) and ground pattern effects are relatively small compared to drop height, drop configuration, or release intervals. Examination of the sensitivity of patterns to aircraft velocity suggests that differences due to velocity over the range of typical drops is less than might be expected. Higher velocities generally reduce peak coverage and increase pattern length at low coverage levels. Slower aircraft velocities tend to increase maximum coverage levels at the expense of the lower coverage pattern lengths. The uncertainty of true airspeed at the time of the drop is generally less than the magnitude of pattern change resulting from the selection of a specific aircraft velocity. Performance in an actual drop may be somewhat better, but seldom worse than the simulation shown in the guides. Level flight over flat terrain is assumed due to the very large number of graphs needed to show the effects of sloping terrain. This effect can be approximated by drawing a sloping line through the pattern footprint graphs in the completed guide.

The schedule of PATSIM runs should include runs for each different type of compartment/drop at 100-foot intervals between 100 and 500 feet. Where identical compartments are released sequentially (trail drop), the PATADD option should be exercised. Because the PATADD option will add only identical compartments, a trail drop where nonidentical compartments are released requires the application of the separate PATSUM Program. This allows the input of two or more patterns for nonidentical compartments obtained from previous PATSIM runs.

Appendix B contains the data from the computer simulation which consists of:

1. Detailed pattern plots used in generating footprints and for entry into the PATSUM routine for summation of dissimilar trail drops.
2. Pattern area, length, and volumes. The remainder is for inspection only.
3. Maximum line length/tank sequence tables from PATADD. These are summarized and plotted to yield best strategy charts and are presented in tabular form in the guides. (PATSUM is used for dissimilar tanks.) Complete instructions for PATSIM use may be found in "Development of User Guidelines for Selected Retardant Aircraft" (Swanson and others 1977).

Detailed Guideline Preparation

A sample guideline is included as appendix C. At the beginning of the guide is a one-page summary of the aircraft/tank characteristics, together with an outline drawing of the aircraft, a detailed isometric tank drawing, a summary table of tank system characteristics, and a narrative summary of the aircraft/tank system performance.

The narrative summary contains an aircraft description and tank options, characteristics of the tank and how they control the pattern, a summary of the best strategy charts, noting the most useful drop methods, ground safety precautions, and any unique characteristics.

The characteristics chart contains the total tank capacity, the increment contained in each separately releasable compartment, evacuation time (total time to empty), the average flow rate (capacity of tank released/evacuation time), and peak flow rate. Peak flow rate is calculated from the flow data used as input to the simulation as:

$$\text{peak flow rate} = \text{maximum value of } \frac{DQ}{DT} \text{ from measured flow data}$$

when DQ is the volume in gallons released during time interval DT.

Pattern Coverage Characteristics (Footprints)

Pattern footprints display pattern performance as a continuous function of drop height for each combination of simultaneously released tanks, door option (if applicable), and each retardant type. The procedure explained below is illustrated in figure 6. Pattern length and initial down-range impact for each coverage level are extracted from the central pattern section (columns 14 or 15) of the detailed pattern plots. All coverage levels are linearly interpolated to the nearest foot of pattern length. At zero drop height, a length representing aircraft travel during the time of tank evacuation is calculated to be used as the end point for the plotted footprints (speed in feet per second evacuation time). These points are plotted for each coverage level 1 through 5 and a smooth curve drawn to form the footprints. Footprint half-width for each coverage level/drop height is found by averaging the width from each row of the detailed pattern plots. These half-widths are plotted and smoothed similarly to the pattern footprints. The values for length, downrange impact point, and width are calculated and tabulated using the summary program LDRWIDTH; the footprint is smoothed using the SMOOTHFOOT program, and final plots are made using FINALFOOT.

Scaled silhouettes of the side and head-on views of the aircraft are placed above the footprint and half-width graphs to indicate the relationships of the graphs to aircraft flight direction. This process is accomplished using several BASIC programs.

Also included on the pages with pattern footprints are a brief set of instructions for use of pattern footprints and a table of recommended coverage levels for different fuel types (Deeming 1972; Rothermel and Philpot 1974). LEDRWIDTH, SMOOTHFOOT, and FINALFOOT are listed in appendix D.

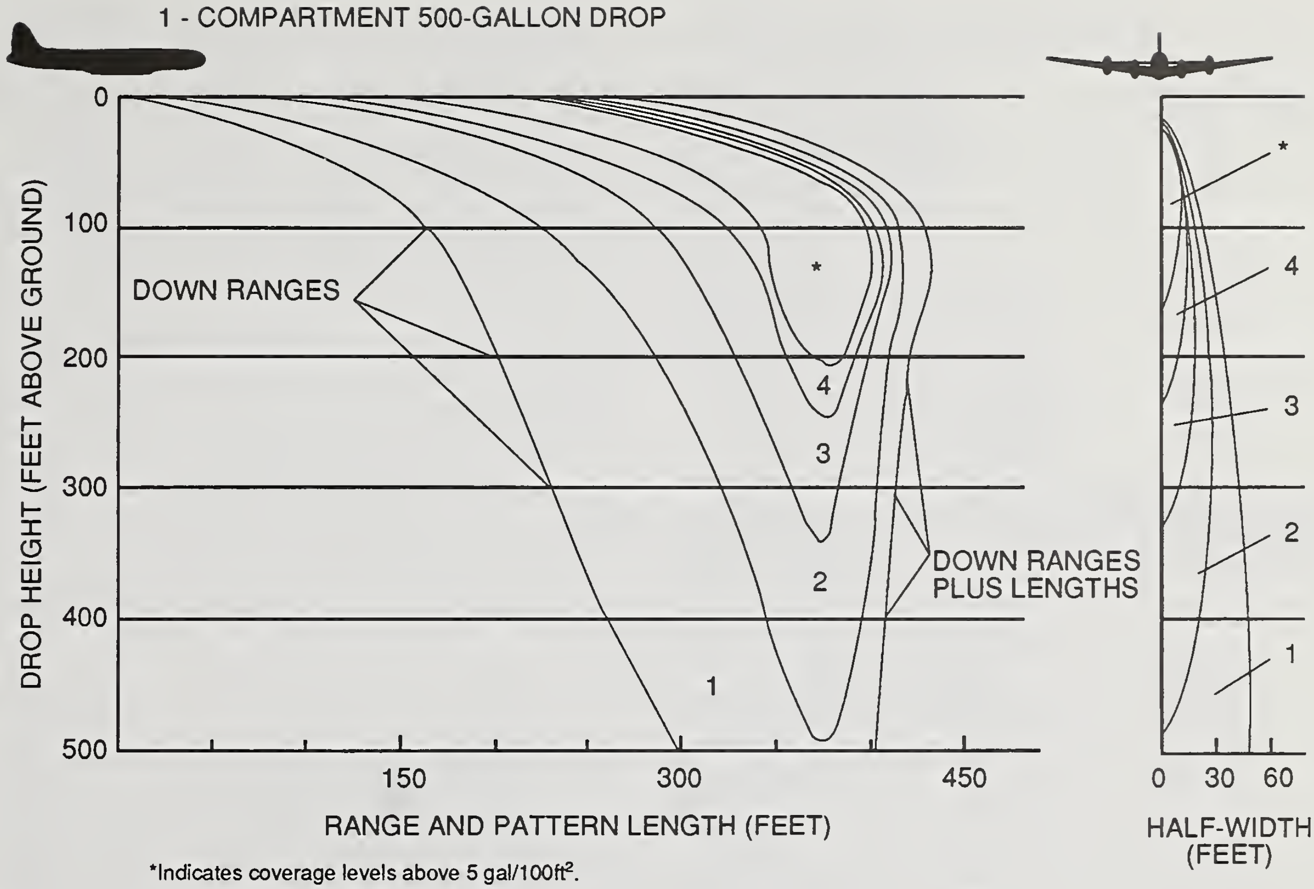


Figure 6—Footprint.

Best Strategy Charts

The section of the guide containing the best strategy charts is preceded by a page of instructions for their use. Best strategy charts are graphic summaries of selected pattern information generated by using the PATADD option to PATSIM (fig. 7). These summaries are also tabulated and presented following the best strategy charts. Best strategy charts are generated for coverage levels 1 through 4 for waterlike and gum-thickened retardants. For a selected coverage level and retardant type, the length of line at drop heights of 100 to 500 feet for each possible load fraction are plotted.

For a tank with four identical compartments, there are six possible combinations:

1. Single-compartment release (1Tx1R)
2. Two compartments released simultaneously (2Tx1R)
3. Four compartments released simultaneously (4Tx1R)
4. Two compartments released sequentially (1Tx2R)
5. Four compartments released sequentially (1Tx4R)
6. Two two-compartment sequential releases (2Tx2R)

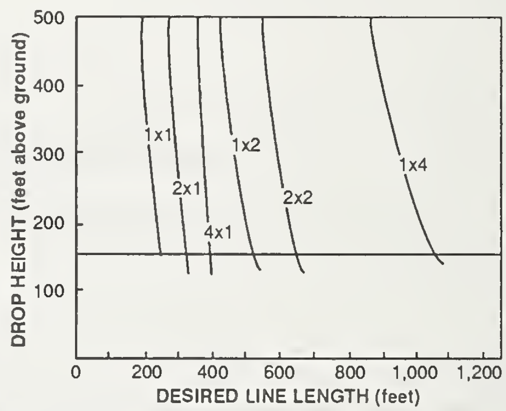
Each of these combinations is regressed, using a standard multiform regression program, and roughly plotted. From this rough plot, the optimum drop for each load size can be selected for the final best trail strategy chart. For example, if the four-compartment in (1Tx4R) produces a longer line length than a four-compartment salvo (4Tx1R), the four-compartment salvo would not be plotted on the final chart (fig. 7) (length and width dimensions for the salvo could be found on the appropriate pattern footprint). Each area is identified with the proper label and a nominal time interval between releases in the case of sequential releases. The proper time interval changes with drop height and airspeed and is reported to 0.1 second. The value of the interval at 200 feet for the drop type in question is chosen as being most representative. A minimum drop height safety limit of 150 feet above ground determined by Forest Service policy is shown on the bottom of the chart.

The accuracy limit curve (Swanson and others 1975) is based on a Honeywell-derived probability of hit for military ordnance and is common to the best strategy charts for all aircraft. It corresponds to a curve defined by setting the probability of hit at 0.6 for no wind and level flight. The curve is drop-height-dependent, indicating the length of line below which a hit is improbable. Because the curve is independent of the pattern width, which is relatively constant for full-door drops, a separate curve is generated for aircraft equipped with a trail door option, which produces a narrower retardant pattern. This arbitrary change simply moves the 300-foot length limit to the 500-foot drop height. Best strategy charts are produced using the BASIC programs: BSPLOT, BESTSTRAT.DAT.

MAXIMUM LINE LENGTHS WITH CORRESPONDING TANK OPENING DELAYS

No. of	0.5 GPC Feet	0.5 GPC Sec	1.0 GPC Feet	1.0 GPC Sec	2.0 GPC Feet	2.0 GPC Sec	3.0 GPC Feet	3.0 GPC Sec	4.0 GPC Feet	4.0 GPC Sec	6.0 GPC Feet	6.0 GPC Sec	8.0 GPC Feet	8.0 GPC Sec	10.0 GPC Feet	10.0 GPC Sec
1	320	0.0	265	0.0	190	0.0	115	0.0	80	0.0	0	0.0	0	0.0	0	0.0
2	665	1.8	560	1.5	420	1.3	310	0.9	225	0.3	125	0.0	80	0.0	50	0.0
4	1335	1.8	1150	1.5	860	1.3	630	0.9	495	0.3	300	0.0	235	0.0	170	0.0

			LEVEL 1				LEVEL 2	
							COV	
			0.5		1.0		2.0	
COMPARTMENTS RELEASED AT A TIME	DROP HT FT	NO.OF PATTERNS	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)
		1	325	0.0	265	0.0	190	0.0
	100	2	665	1.8	560	1.5	420	0.0
		4	1355	1.8	1150	1.5	860	0.0
		1	295	0.0	235	0.0	150	0.0
	200	2	615	1.6	495	1.3	350	0.0
		4	1255	1.6	1015	1.3	735	0.0
		1	280	0.0	215	0.0	115	0.0
ONE	300	2	585	1.6	455	1.2	295	0.0
		4	1195	1.6	935	1.2	625	0.0
		1	275	0.0	205	0.0	95	0.0
	400	2	575	1.5	450	1.2	250	0.0
		4	1175	1.5	930	1.2	550	0.0
		1	265	0.0	195	0		
	500	2	555	1.5	420			
		4	1135	1.5	860			
	100	1	375	0.0	335			
		2	765	2.0	69			
	200	1	370	0.0	3			
		2	750	1.8				



SAFE DROP HEIGHT

DROP TYPE	FEET
1X1	170
2X1	200
4X1	240

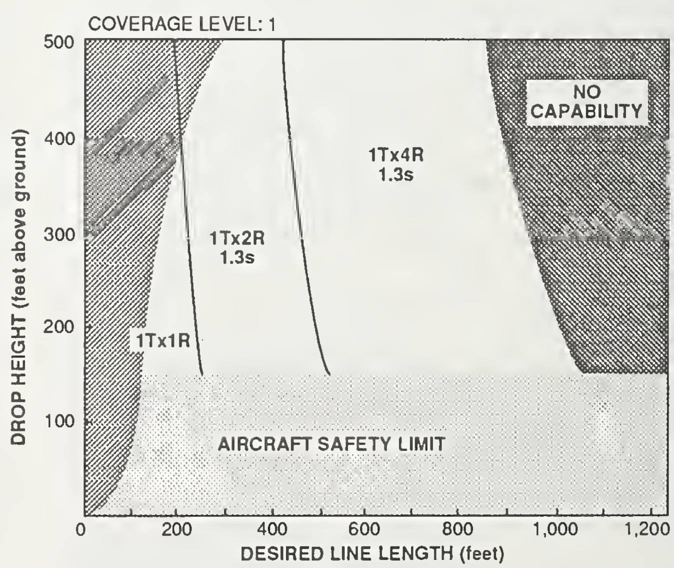


Figure 7—Airtanker characteristics.

Included on the pages containing best strategy charts are a key to the notation on the charts, the table of recommended coverage levels, and a table of ground safety notes. The ground safety table shows for each load type the height below which the retardant mass has lost forward momentum and broken up into droplets, falling as a heavy rain. The equation for these heights was derived from films of test drops and is a function of load size and peak flow rate: Safe drop height = (100.73 + 0.0112 x load size + 0.0202 x peak flow rate) + 50. The arbitrary 50 feet are added as a safety margin.

The remainder of the guide consists of detailed tables of the aircraft's performance transcribed and rearranged from the PATADD subroutine and technical data tables. The technical data tables contain some physical dimensions of the tank system and flow data derived from the static test. These tables potentially enable field personnel to identify tank changes that might affect the guide validity or to judge the similarity to tank systems for which guides are not available. Also included are the date and full identification of the tanker static-tested and any other identical airtankers.

SUMMARY

To date airtanker performance guidelines have been published for most of the airtankers currently being used. These are listed in table 2. An instruction manual, "Airtanker Performance Guides: General Instruction Manual" (Swanson and others 1976) contains detailed instructions on how to read and use airtanker performance guides that contains general information, retardant coverage requirements, pattern footprints, best strategy charts and detailed line length tables.

A need was identified for a small, simple, inexpensive reference that could be used in real-time to identify primary airtanker performance. To fill this need airtanker performance "slide charts" (retardant coverage computers) have been developed along with an instruction manual for their use (George 1981). The retardant coverage computers are a slide-rule-type device that can quickly show the user the length of retardant line and the intertank release interval used for any coverage level (1.0 – 5.0 + gpc), drop height from 100 to 500 feet, and drop type. Retardant coverage computers have been produced for each airtanker covered by performance guides.

As new types of tank and gating systems, whether new aircraft types or systems modified to improve flexibility and performance, come into use, new or updated guides and slide charts should be produced in order to keep this valuable information current and useful.

With the advent of computer-based intervalometers to select drop types and intervals in the newer airtankers, a potential exists to include ground pattern performance data in the intervalometer. The desired coverage level could be selected and the computer could set, or indicate to the air crew, the most effective drop type and interval.

Table 2—List of airtanker performance guidelines

Aero Union tanker B–17	(Request by title)
Gilbertson tanker DC–6B	(Request by title)
CDF/Hemet Valley tanked S2F	PG-1
CDF/Aero Union tanked S2F	PG–2
Ralco tanked PV–2	PG–3
Reeder Tank/Lynch STOL B–26 (tanker 58)	PG–4
Canadair CL–215	PG–5
Evergreen Rosenbalm tanked B–17	PG–6
Globe tanked B–17	PG–7
Black Hills tanked B–17	PG–8
Aero Union tanked DC–4/6/7 (1,800 gal)	PG–9
Aero Union tanked DC–4/6/7 (2,000 gal)	PG–10
Aero Union tanked DC–4/6/7 (2,200 gal)	PG–11
Aero Union tanked DC–4/6/7 (2,400 gal)	PG–12
Aero Union tanked DC–4/6/7 (2,600 gal)	PG–13
Aero Union tanked DC–4/6/7 (2,800 gal)	PG–14
Aero Union tanked DC–4/6/7 (3,000 gal)	PG–15
W.A.I.G. tanked DC–4	PG–16
Hemet Valley/Aero Union tanked C119G–3E	PG–17
Hawkins & Powers tanked C119G–3E	PG–18
Hawkins & Powers tanked PB4Y–2	PG–19
Black Hills/Rosenbalm tanked P2V–5	PG–20
Black Hills/Rosenbalm tanked P2V–7	PG–21
Central Air Services tanked DC–7	PG–22
Transwest tanked DC–7	PG–23
SIS–Q/Rosenbalm tanked DC–6/7 (3,000 gal)	PG–24
C–130 MAFFS	PG–25
Black Hills tanked P2V–5	PG–26
Lynch tanked STOL B–26 (tanker 01)	PG–27
Evergreen P2V–5	PG–29
SIS–Q/Rosenbalm tanked DC–6/7 (2,000 and 2,450 gal)	PG–30
TBM, Inc. F7F	PG–31
Lynch STOL B–26 (tanker 57)	PG–32
Central Air Services DC–4 (2,000 gal)	PG–33
Conair DC–6B	PG–34
TBM, Inc. C–123	PG–35

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APPENDIX A: PATSIM LISTING

```
110 REM PROGRAM PATSIM(INPUT,OUTPUT,TAPCONV=INPUT,TAPTERED=OUTPUT)
120 REM (*) COMMON/MIX/DST(1700),SUMD,RAT
121 DIM Dst[1700]
130 REM (*) COMMON /ADD/ NPTS,VALIN(56),ITC(8)
131 DIM Valin[56],Itc[8]
140 DIM Tim1[500],Vex[500],Qo[2500],Qdoto[2500],Qdotx[500]
150 DIM Zo[2500],Veo[2500],Vzo[2500]
160 DIM Dss[200]
170 REM (*) REAL K1,K2
180 DIM A[90]
185 DIM Itc[8]
200 DIM Ttim[100],Thim[100]
205 Ctrl$ = CHR$(12)
210 IMAGE 8(4D.5D)
220 IMAGE 8(5E)
221 IMAGE 3(5E,4X)
230 IMA 1A,20X,"S T A N D A R D  P A T T E R N  S I M U L A T I O N ",1l,30X,"R E T A R D A N T  P A T T E R N",21
240 IMAGE 5X,5D,3X,6E
250 IMAGE 20(4A)
260 IMAGE 1(1A)
270 IMAGE 10X,80A
280 IMAGE 2L,10X,"VELOCITY(KNOTS)=",8D,1L,10X,"ALTITUDE(FEET)= ",8D
281 INPUT PROMPT "What data file? ":F$
282 OPEN #1:F$,"r"
283 ON EOF(1) GOTO 2550 ! End of program
284 OPEN #7:"prn ","w"
300 A = 0 ! Initalize A
310 A[32] = 0 ! Bflag
320 A[18] = 1 ! Cflag
330 A[37] = 1 ! Alf
340 A[40] = 3.97 ! K1
350 A[41] = 12 ! K2
360 A[42] = 0.002 ! Delt
370 A[43] = 10 ! Tr
380 A[44] = 0.02 ! Tx
390 Irdqv = 0
400 A[45] = 1 ! Rflag
410 REM (*) CONTINUE
411 DELETE Tp,Lcon,Conv,Sing,Lcmax,Dela
412 DIM Dst[1700],Qo[2500],Qdoto[2500] ! ,Qdotx[500],TIM1[500],VEX[500]
413 DIM Zo[2500],Veo[2500],Vzo[2500]
420 PRINT #7 USING 230:Ctrl$
440 INPUT #1:A$ ! Read from data file
441 IF A$="" THEN 2550
450 Atst$ = SEG$(A$,1,1) | IF Atst$="*" THEN 1350 ! Is this a remark line?
460 IF A$=" " THEN 1370 ! Is this the end of a data set?
465 A1 = VAL(A$) ! A1 is the variable code
470 IF A1<0 THEN 1370
480 INPUT #1:A2 ! A2 is the value of the variable
510 PRINT #7 USING 240:A1,A2
530 J = A1 ! Renaming the variable label
540 IF J<=0 THEN 1300
550 A[J] = A2 ! Renaming the variable value
555 GOSUB 10000 ! Subroutine to change the names in the A array
```

```
556 IF J<>5 THEN 560
557 INPUT #1:M,N$,C$ ! drop#, comment, file for storage
560 IF J<>53 OR A[53]<=0 THEN 580 ! Not Add
561 FOR K = 1 TO 8 | INPUT #1:Itc[K] | NEXT K ! Which patterns are computed?
570 IMAGE 8(1D)
580 IF J<>30 THEN 620 ! Not Ttab (tabular door angle vs time)
590 IF A[J]=0 THEN 620 ! Ttab=0 deselected (Tabular door angle vs time)
600 PRINT #7 USING 601:
601 IMAGE 11,"DOOR ANGLE VS TIME DATA",7X,"TIME-SEC",6X,"ANGLE-DEG"
610 INPUT #1:Ttim[N],Thtim[N] ! Door angle vs time data
620 REM (*) CONTINUE
630 IF J<>24 THEN 1300 ! Not Rdqv (Quantity discharged vs time)
640 IF A[J]=0 THEN 1300 ! Rdqv=0 deselected (Quantity discharged vs time)
650 IF A[J]>0 THEN 780 ! Rdqv selected (Quantity discharged vs time)
660 REM INPUT Q AND THETA VS. TIME AND USE  TABLE AS IS
670 Rdqv = -Rdqv
680 Ant = Rdqv
690 Nt = Ant ! number of points read from file
700 FOR N = 1 TO Nt | INPUT #1:Tim1[N],Qdoto[N],Veo[N] | NEXT N ! Read data
710 IMA " QUANTITY AND DOOR ANGLE VS TIME DATA",11,2X,"TIME-SEC",8X,"Q-GAL",8X,"ANGLE-DEG"
720 PRINT #7 USING 710:
730 FOR N = 1 TO Nt
740   PRI #7 USI 220:Tim1[N],Qdoto[N],Veo[N] ! Quantity disc. and theta vs time
741 NEXT N
750 GOTO 1280
760 REM INPUT Q AND THETA VS. TIME, INTERPOLATE VALUES EVERY TX SECONDS,
770 REM AND EXTRAPOLATE THE TABLE TO GALI NUMBER OF CALLONS
780 Nti = Rdqv
790 FOR N = 1 TO Nti | INPUT #1:Qo[N],Zo[N],Vzo[N] | NEXT N ! Read data
800 PRINT #7 USING 710:
810 FOR N = 1 TO Nti
820   PRINT #7 USING 221:Qo[N],Zo[N],Vzo[N] ! Quantity disc. and theta vs time
821 NEXT N
830 Tim1[1] = 0 ! Beginning the extrapolation between Time,Quantity points
840 Qdoto[1] = 0
850 Veo[1] = 0
860 I = 1
870 I = I+1
880 Tim1[I] = Tim1[I-1]+Tx
890 FOR N = 1 TO Nti
900   ON SGN(Tim1[I]-Qo[N])+2 GOTO 1060,990,910
910   REM (*) CONTINUE ! Case: positive values
911 NEXT N
920 Timsav = Tim1[I]
930 Tim1[I] = Qo[Nti]
940 Qdoto[I] = Zo[Nti]
950 Veo[I] = Vzo[Nti]
960 Ant = I
970 Nt = I
980 GOTO 1090
990 Qdoto[I] = Zo[N] ! Case: zero
1000 Veo[I] = 0.5*(Vzo[N]+Vzo[N-1])
1010 IF N<>Nti THEN 870
1020 Timsav = Tim1[I]+Tx
1030 Ant = I
1040 Nt = I
```

```
1050 GOTO 1090
1059 ! Case: negative values
1060 Qdoto[I] = (Tim1[I]-Qo[N-1])/(Qo[N]-Qo[N-1])*(Zo[N]-Zo[N-1])+Zo[N-1]
1070 Veo[I] = 0.5*(Vzo[N]+Vzo[N-1])
1080 GOTO 870
1090 IF Qdoto[I]>=Gali-1.E-06 THEN 1280 ! extrapolation finished?
1100 Tfin = (Gali-Zo[Nti-1])/(Zo[Nti]-Zo[Nti-1])*(Qo[Nti]-Qo[Nti-1])+Qo[Nti-1]
1110 I = I+1
1120 Tim1[I] = Timsav
1130 GOTO 1160
1140 I = I+1
1150 Tim1[I] = Tim1[I-1]+Tx
1160 IF Tim1[I]>Tfin THEN 1230
1170 Qdoto[I] = (Gali-Zo[Nti])*((Tim1[I]-Qo[Nti])/(Tfin-Qo[Nti]))+Zo[Nti]
1180 Veo[I] = Vzo[Nti]
1190 IF Tim1[I]<Tfin THEN 1140
1200 Ant = I
1210 Nt = I
1220 GOTO 1280
1230 Tim1[I] = Tfin
1240 Qdoto[I] = Gali
1250 Veo[I] = Vzo[Nti]
1260 Ant = I
1270 Nt = I
1280 REM (*) CONTINUE ! End of extrapolating between points
1290 Irdqv = 1 ! set flag quantity dischaged data read from file
1300 REM (*) CONTINUE
1310 GOTO 440
1320 STOP
1350 PRINT #7 USING 270:A$ ! Print comment line
1360 GOTO 440
1370 REM (*) CONTINUE
1380 PRINT #7 USING 280:Vaci,Alt1 ! End of reading data set
1390 K1 = 3.97
1400 IF Rflag=2 THEN K1 = 4.4 ! flag Rflag=2 for water-like retardants
1410 Ve = 0.0
1420 FOR J = 1 TO 1700 ! initalize Dst
1430   Dst[J] = 0.0
1440   REM (*) CONTINUE
1441 NEXT J
1450 FOR I = 1 TO 100 ! initalize Dss
1460   Dss[I] = 0.0
1470   REM (*) CONTINUE
1471 NEXT I
1510 Jr = Tr
1520 Jr2 = Jr/2
1530 Vac = Vaci*1.689 ! knots to feet per second
1540 Gal = Gali*Cflag ! amount of retardant released
1550 K = 1
1560 Dt = 0.02
1580 G = 32.17 ! acceleration due to gravity
1590 G2 = 2.0*G
1600 IF Irdqv<1 THEN 1680 ! flag Irdqv=1 then data read from file
1610 Qdotx[1] = 0
1620 Vex[1] = 0
1630 FOR N = 2 TO Nt ! for constant ejection velocity=16 fps
1640   Qdotx[N] = (Qdoto[N]-Qdoto[N-1])*0.13368/(Tim1[N]-Tim1[N-1])
```

```
1650   Vex[N] = 16
1660   REM (*) CONTINUE
1661 NEXT N
1670 Irdqv = 0
1680 REM (*) CONTINUE
1690 IF A[54]<>0 THEN 410 ! flag A(54)=1 stop after flow value is determined
1700 Dt = 0.02
1710 Z = 0
1720 Delz = 4.0
1730 Jk = -Jr2+1
1740 Xout = 1
1750 Qsum = 0
1760 Zt = 0
1770 Dqout = Qdotx[1]
1780 FOR N = 2 TO Nt
1790   Jk = Jk+Jr
1800   Dt = Tim1[N]-Tim1[N-1]
1810   Qs = Qdotx[N]*Dt
1820   Qsum = Qs+Qsum
1830   IF Bflag<>1 THEN 1850 ! Bflag=1 then print bulk increment data
1840   PRINT #7 USING 220:Tim1[N],Vex[N],Qdotx[N],Qs,Qsum
1850   REM (*) CONTINUE
1860   REM (*) CONTINUE
1861 NEXT N
1870 IF Bflag<>2.0 THEN 1890
1880 GOTO 410
1890 REM (*) CONTINUE
1900 Ant = Nt
1910 Xout = 1.0
1920 Xlast = 1.0
1930 Qqq = 0.0
1940 FOR Km = 2 TO Nt
1950   Dt = Tim1[Km]-Tim1[Km-1] ! time
1960   Qsum = 0.0
1970   Ve = Vex[Km] ! ejection velocity
1980   Qdot = Qdotx[Km]
1990   Q = Qdot*Dt*Cflag ! quantity discharged
2000   IF Q<=0 THEN 2310
2010   Qqq = Qqq+Q ! cummulative quantity discharged
2020   Xout = 1
2030   Zt = 0
2040   Xx = 0
2050   Tstar = 0
2060   Tmt = Tim1[Km]
2070   Xlast = Tmt*Vac
2080   FOR Jj = 2 TO 100
2090     Zt = Zt+Delz
2100     V = SQR(Ve^2+G2*Zt)
2110     Tstar = Delz/V+Tstar
2120     Ttt = Tstar+Tmt
2130     Dqd = EXP(K1*Tstar)/(Vac*Q)*K2
2140     Xx = Delz*Vac/V+Xx
2150     Xout = Xx+Tmt*Vac
2160     Xr = Xout
2170     Nl1 = Xlast
2180     Nl2 = Xr
2190     Diff = Xr-Xlast+1
```

```
2200     Dqout = Delz/V*Dqd
2210     REM      DENS=DQD*DELZ/(V*DIFF)
2220     IF Dqout>Q-Qsum THEN Dqout = Q-Qsum
2230     Dens = Dqout/Diff
2240     FOR N2 = INT(N11) TO INT(N12) ! calculating dst
2250       Dst[N2] = Dst[N2]+Dens
2251     NEXT N2
2260     Qsum = Qsum+Dqout
2270     Xlast = Xout
2280     IF Qsum>=Q THEN EXIT TO 2300
2290     REM (*) CONTINUE
2291   NEXT Jj
2300   REM (*) CONTINUE
2310   REM (*) CONTINUE
2311 NEXT Km
2320 Jm = 0
2330 Sumd = 0
2340 FOR N3 = 1 TO 1700
2350   Sumd = Sumd+Dst[N3]
2360   REM (*) CONTINUE
2361 NEXT N3
2370 Jk = 0
2380 Rat = Gal/Sumd
2390 FOR Ij = 1 TO 1700 STEP 25
2400   Jk = Jk+1
2410   FOR Jj = 1 TO 25
2420     Jm = Ij+Jj-1
2430     Dss[Jk] = Dss[Jk]+Dst[Jm]
2440     REM (*) CONTINUE
2441   NEXT Jj
2450   Dss[Jk] = Dss[Jk]*Rat
2460   REM (*) CONTINUE
2461 NEXT Ij
2470 Sumk = 0
2480 FOR I = 1 TO 68
2490   Sumk = Dss[I]+Sumk
2500   REM (*) CONTINUE
2501 NEXT I
2510 REM CALL MIXUN(GAL,VACI,ALT1,RFLAG,FPAT,FRAN,FE)
2511 PRINT "subroutine MIXUN"
2512 GOSUB 2560
2520 IF Add<=0 THEN 410 ! don't calculate line length table
2530 REM CALL PATADD (VACI)
2531 PRINT "subroutine PATADD"
2532 GOSUB 6550
2540 GOTO 410
2550 CLOSE
2551 REM
2552 END
2560 REM SUBROUTINE MIXUN(GAL,VAC,ALT1,RFLAG,FPAT,FRAN,FE)
2570 REM (*) COMMON/MIX/DST(1700),SUMD,RAT
2580 REM (*) COMMON /ADD/ NPTS,VALIN(56),ITC(8)
2590 DIM Ud[28,56],Nd[28,56],Cd[28,56]
2600 DIM Mi[60],Mo[60],M1[60],M2[60]
2610 DIM Cmi[60],Cmo[60],Cm1[60],Cm2[60]
2620 DIM P[15]
2630 DIM Mii[60],Cmii[60]
```

```
2640 REM (*) REAL ND,LAMDA,MI,MO,M1,M2,CMII
2650 Im = 28
2660 Jm = 56
2670 Delx = 15
2680 Dely = 30
2690 Alt2 = Alt1*Alt1
2700 IF Rflag>1 THEN 2850
2710 REM      C-R PARAMETERS FOR PHOSCHEK RETARDANT
2720 IF Vaci<=130 THEN 2750
2730 Semx = 40.0+0.104048*Alt1-6.90477E-05*Alt2
2740 GOTO 2760
2750 Semx = 40.0+0.255714*Alt1-0.000185714*Alt2
2760 REM (*) CONTINUE
2770 Lamda = 0.15+5.E-05*Alt1
2780 IF Vaci<=130 THEN 2810
2790 Sigma = 8.0+0.0485715*Alt1-2.85715E-05*Alt2
2800 GOTO 2820
2810 Sigma = 8.0+0.0659048*Alt1-4.19048E-05*Alt2
2820 REM (*) CONTINUE
2830 Pctr = 85.18-0.00535*Alt1
2840 GOTO 2960
2850 REM (*) CONTINUE
2860 REM      C-R PARAMETERS FOR WATER LIKE RETARDANTS
2870 IF Alt1>482 THEN 2910
2880 Semx = 27.5583+0.222214*Alt1
2890 Sigma = 3.11609+0.0746535*Alt1
2900 GOTO 2930
2910 Semx = 135
2920 Sigma = 36.0427+0.00821018*Alt1
2930 REM (*) CONTINUE
2940 Lamda = 0.15+5.E-05*Alt1
2950 Pctr = 75.18-0.02487*Alt1
2960 REM (*) CONTINUE
2970 REM
2980 Areaf = 100/(Delx*Dely)
2990 REM      FORM MARGINAL RANGE WITH CELL SIZE = DELY
3000 FOR I = 1 TO Jm
3010   Mi[I] = 0
3011 NEXT I
3020 Jk = 0
3030 FOR Ij = 1 TO 1680 STEP 30
3040   Jk = Jk+1
3050   FOR Jj = 1 TO 30
3060     Jn = Ij+Jj-1
3070     Mi[Jk] = Mi[Jk]+Dst[Jn]
3080     REM (*) CONTINUE
3081   NEXT Jj
3090   Mi[Jk] = Mi[Jk]*Rat
3100   REM (*) CONTINUE
3101 NEXT Ij
3110 FOR I = 1 TO Jm
3120   Mii[I] = Mi[I]*(Pctr/100.0)
3121 NEXT I
3130 REM
3140 REM      FORM ELLITICAL UNIFORM GROUND DISTRIBUTION AND MARGINAL
3150 Xm = Im/2.0*Delx
```

```
3160 FOR I = 1 TO Im
3170   FOR J = 1 TO Jm
3180     Ud[I,J] = 0
3190     Nd[I,J] = 0
3200     Cd[I,J] = 0
3201   NEXT J
3202 NEXT I
3210 Jm1 = 1
3220 FOR I = 1 TO Jm
3230   IF Mi[I]>0 THEN EXIT TO 3260
3240   Jm1 = Jm1+1
3250   REM (*) CONTINUE
3251 NEXT I
3260 REM (*) CONTINUE
3270 FOR I = Jm1 TO Jm
3280   IF Mi[I]<=0 THEN EXIT TO 3310
3290   Jm2 = I
3300   REM (*) CONTINUE
3301 NEXT I
3310 REM (*) CONTINUE
3320 A2 = Semx^2
3330 B2 = ((Jm2-Jm1+1)*Dely/2.0)^2
3340 Ym = (Jm2+Jm1-1)*Dely/2.0
3350 Nc = 0
3360 X = -Delx/2
3370 FOR I = 1 TO Im
3380   X = X+Delx
3390   Y = -Dely/2
3400   FOR J = 1 TO Jm
3410     Y = Y+Dely
3420     Ee = (X-Xm)^2/A2+(Y-Ym)^2/B2
3430     IF Ee-1>0 THEN 3460
3440     Ud[I,J] = 1
3450     Nc = Nc+1
3460     REM (*) CONTINUE
3461   NEXT J
3470   REM (*) CONTINUE
3471 NEXT I
3480 Fe = 1.0/INT(Nc)
3490 Ae = Lamda*Gal*(Pctr/100.0)
3500 Ca = Fe*Ae
3510 FOR I = 1 TO Im
3520   FOR J = 1 TO Jm
3530     IF Ud[I,J]=1 THEN Ud[I,J] = Ca
3540     REM (*) CONTINUE
3541   NEXT J
3542 NEXT I
3550 FOR J = 1 TO Jm
3560   M1[J] = 0
3570   FOR I = 1 TO Im
3580     M1[J] = M1[J]+Ud[I,J]
3590     REM (*) CONTINUE
3591   NEXT I
3600   REM (*) CONTINUE
3601 NEXT J
3610 REM
3620 REM      SUBTRACT UNIFORM MARGINAL FROM MACPHERSON MARGINAL
```

```
3630 FOR J = 1 TO Jm
3640   Temp = Mii[J]-M1[J]
3650   ON SGN(Temp)+2 GOTO 3660,3680,3680
3660   M2[J] = 0
3670   GOTO 3690
3680   M2[J] = Temp
3690   REM (*) CONTINUE
3691 NEXT J
3700 REM
3710 REM      DEVELOP NORMAL DISTRIBUTION CONDITIONALS
3720 Pl = 0.5
3730 Im2 = INT(Im/2)
3740 X = 0
3750 FOR I = 1 TO Im2
3760   X = X+Delx
3770   Xos = X/Sigma
3778   GOTO 4800
3780   Pn = Cdfn
3790   IF Xos>4 THEN Pn = 1
3800   P[I] = Pn-Pl
3810   Pl = Pn
3820   REM (*) CONTINUE
3821 NEXT I
3830 FOR J = 1 TO Jm
3840   IF M2[J]<=0 THEN 3920
3850   FOR I = 1 TO Im2
3860     I1 = Im2-I+1
3870     I2 = I+Im2
3880     Temp = P[I]*M2[J]
3890     Nd[I1,J] = Temp
3900     Nd[I2,J] = Temp
3910     REM (*) CONTINUE
3911   NEXT I
3920   Mo[J] = M1[J]+M2[J]
3930   REM (*) CONTINUE
3931 NEXT J
3940 REM      COMBINE UNIFORM AND NORMAL DISTRIBUTIONS
3950 Sum1 = 0
3960 Sum2 = 0
3970 Sum3 = 0
3980 Sum4 = 0
3990 Sum9 = 0
4000 FOR J = 1 TO Jm
4010   Sum1 = Sum1+Mi[J]
4020   Sum9 = Sum9+Mii[J]
4030   Sum2 = Sum2+M1[J]
4040   Sum3 = Sum3+M2[J]
4050   Sum4 = Sum4+Mo[J]
4051 NEXT J
4060 Sum5 = 0
4070 Sum6 = 0
4080 Sum7 = 0
4090 Sum8 = 0
4100 Sum10 = 0
4110 FOR J = 1 TO Jm
4120   Sum5 = Sum5+Mi[J]
4130   Sum10 = Sum10+Mii[J]
```

```
4140   Sum6 = Sum6+M1[J]
4150   Sum7 = Sum7+M2[J]
4160   Sum8 = Sum8+Mo[J]
4170   Cmi[J] = Sum5/Sum1
4180   Cmii[J] = Sum10/Sum9
4190   Cm1[J] = Sum6/Sum2
4200   Cm2[J] = Sum7/Sum3
4210   Cmo[J] = Sum8/Sum4
4220   FOR I = 1 TO Im
4230     Ud[I,J] = Ud[I,J]*Areaf
4240     Nd[I,J] = Nd[I,J]*Areaf
4250     Cd[I,J] = Ud[I,J]+Nd[I,J]
4260     REM (*) CONTINUE
4261   NEXT I
4270   REM (*) CONTINUE
4271 NEXT J
4280 REM      OUTPUT RESULTS
4290 PRINT #7 USING 4750:Ctrl$
4300 PRINT #7 USING 4760:
4305 PRINT #7 USING "4X,S":
4310 FOR I = 1 TO Im | PRINT #7 USING "4D,S":I | NEXT I
4315 PRINT #7:
4320 FOR J = 1 TO Jm
4330   PRINT #7 USING "3D,1X,S":J
4340   FOR I = 1 TO Im | PRINT #7 USING 4780:Cd[I,J] | NEXT I
4341   PRINT #7:
4342 NEXT J
4350 IF Fpat<=1 THEN 4630
4360 REM      MULTIPLE PATTERN CODING
4370 Npat = Fpat-1
4380 Nran = Fran
4390 Ncran = Fcran
4400 FOR I = 1 TO Im
4410   FOR J = 1 TO Jm
4420     Nd[I,J] = Cd[I,J]
4421   NEXT J
4422 NEXT I
4430 Nc = 0
4440 Nr = 0
4450 FOR N = 1 TO Npat
4460   Nc = Nc+Ncran
4470   Nr = Nr+Nran
4480   FOR I = 1 TO Im
4490     I1 = INT(I)-INT(Nc)
4510     FOR J = 1 TO Jm
4520       J1 = J-Nr
4530       IF J1<1 OR J1>Jm THEN 4550
4540       Cd[I,J] = Cd[I,J]+Nd[I1,J1]
4550       REM (*) CONTINUE
4551     NEXT J
4560     REM (*) CONTINUE
4561   NEXT I
4570   REM (*) CONTINUE
4571 NEXT N
4580 PRINT #7 USING 4750:
4590 PRINT #7 USING 4640:
4600 FOR I = 1 TO Im | PRINT #7 USING 4770:I | NEXT I
```

```
4610 FOR J = 1 TO Jm
4620   FOR I = 1 TO Im | PRINT #7 USING 4780:J,Cd[I,J] | NEXT I
4621 NEXT J
4630 REM (*) CONTINUE
4640 IMAGE 47X,"MULTIPLE PATTERN DATA"
4650 REM CALL UNCOM(CD,GAL)
4651 PRINT "subroutine UNCOM"
4652 GOSUB 5250
4655 IF A[5]>0 THEN GOSUB 20000
4660 REM CALL PPRINT(CD)
4661 PRINT "subroutine PPRINT"
4662 GOSUB 5990
4670 Npts = 0
4680 FOR J = 1 TO Jm
4690   IF Cd[14,J]=0 THEN 4730
4700   Npts = Npts+1
4710   Valin[J] = Cd[14,J]
4720   REM (*) CONTINUE
4721 NEXT J
4730 REM (*) CONTINUE
4740 RETURN
4750 IMAGE 1A
4760 IMAGE 47X,"DETAILED PATTERN DATA"
4780 IMAGE 2D.1D,S
4790 END
4800 REM FUNCTION CDFN(X)
4810 DIM Af[6],Df[6],Cf[6,10]
4820 DIM Ef[60]
4830 REM (*) EQUIVALENCE (E(1),C(1,1))
4835 RESTORE 4840
4840 DATA 0.625,1.25,2.0,2.45,3.5,4.62
4841 FOR J = 1 TO 6 | READ Af[J] | NEXT J
4850 DATA 0.3,0.925,1.625,2.225,2.95,4.15
4851 FOR J = 1 TO 6 | READ Df[J] | NEXT J
4860 DATA 0.00067982403291,-0.0012709753598,0.000679645257
4865 DATA -8.8500314297E-05,1.4791554152E-07,5.4879072878E-07
4870 DATA 0.0051028640888,-0.0014822649744,-3.4589883732E-07
4880 DATA 0.00056826070991,-6.1965013125E-05,-8.6656125337E-07
4890 DATA -0.0060160862379,0.0087718965604,-0.0030883401043
4900 DATA -0.00045015531032,0.00022266710841,6.6877769441E-07
4910 DATA -0.022725611373,-0.0020200415601,0.0072141082947
4920 DATA -0.0013872389725,-0.00044390018986,-6.4084653798E-07
4930 DATA 0.033555772127,-0.034681674488,-0.001067703944
4940 DATA 0.0055422185916,0.00062978750848,6.2471782478E-07
4950 DATA 0.072703311825,0.047642403207,-0.024859750804
4960 DATA -0.010221129286,-0.00066382630882,-4.2105004094E-07
4970 DATA -0.14093895854,0.056850293056,0.057420315819
4980 DATA 0.011850195831,0.00051265678121,2.0742133302E-07
4990 DATA -0.1546891297,-0.22180615138,-0.06538370517
5000 DATA -0.0088864030978,-0.00027657162532,-0.076856040218
5010 DATA 0.5156304546,0.23979043073,0.040236129479
5020 DATA 0.0039938885701,9.3751413487E-05,1.8722020822E-08
5030 DATA 0.16431337971,0.40458836515,0.48922186659
5040 DATA 0.49917416726,0.49998489849,0.49999999779
5041 FOR J = 1 TO 60 | READ Ef[J] | NEXT J
5042 FOR J = 1 TO 10
5043   FOR K = 1 TO 6
```

```
5044     Cf[K,J] = Ef[(J-1)*6+K]
5045   NEXT K
5046 NEXT J
5050 Y = Xos*0.70710678119
5060 Sgny = 1
5070 ON SGN(Y)+2 GOTO 5100,5080,5120
5080 Cdfn = 0.5
5090 GOTO 3780
5100 Sgny = -1
5110 Y = -Y
5120 FOR K = 1 TO 6
5130   IF Y-Af[K]<=0 THEN EXIT TO 5170
5140   REM (*) CONTINUE
5141 NEXT K
5150 Z = 0.5
5160 GOTO 5220
5170 Y = Y-Df[K]
5180 Z = Cf[K,1]
5190 FOR J = 2 TO 10
5200   Z = Z*Y+Cf[K,J]
5210 NEXT J
5220 Cdfn = 0.5+Sgny*Z
5230 GOTO 3780
5240 END
5250 REM SUBROUTINE UNCOM(CD,GALLON)
5260 REM
5270 REM         COMPUTES CONTOURS FOR SIMULATED PATTERNS
5280 REM
5290 DIM Cd[28,56],Btot[12],Itot[12]
5300 DIM Cmean[12]
5310 REM (*) REAL ITOT
5320 DATA 0.1,0.6,1.5,2.5,3.5,4.5,5.5,6.5,7.5,8.5,9.5,10.5
5330 RESTORE 5320
5340 FOR I = 1 TO 12 | READ Cmean[I] | NEXT I
5350 Im = 28
5360 Jm = 56
5370 Sum0 = 0
5380 Sum1 = 0
5390 FOR I = 1 TO 12
5400   Btot[I] = 0
5410   Itot[I] = 0
5411 NEXT I
5420 FOR I = 1 TO Im
5430   FOR J = 1 TO Jm
5440     Tot = Cd[I,J]
5450     IF Tot=0 THEN 5690
5460     IF Tot>0 AND Tot<=0.2 THEN 5480
5470     GOTO 5520
5480     Btot[1] = Btot[1]+Tot
5490     Itot[1] = Itot[1]+1
5500     Sum0 = Sum0+Tot*4.5
5510     GOTO 5690
5520     IF Tot>0.2 AND Tot<=1 THEN 5540
5530     GOTO 5580
5540     Btot[2] = Btot[2]+Tot
5550     Itot[2] = Itot[2]+1
5560     Sum0 = Sum0+Tot*4.5
```

```
5570     GOTO 5690
5580     FOR K = 1 TO 9
5590       IF Tot>K AND Tot<=K+1 THEN 5610
5600       GOTO 5650
5610       Btot[K+2] = Btot[K+2]+Tot
5620       Itot[K+2] = Itot[K+2]+1
5630       Sum0 = Sum0+Tot*4.5
5640       EXIT TO 5690
5650       REM (*) CONTINUE
5651     NEXT K
5660     Btot[12] = Btot[12]+Tot
5670     Itot[12] = Itot[12]+1
5680     Sum0 = Sum0+Tot*4.5
5690     REM (*) CONTINUE
5691   NEXT J
5692 NEXT I
5700 FOR I = 1 TO 12
5710   Btot[I] = Btot[I]*4.5
5711 NEXT I
5720 Perr = Sum0/Gal*100
5730 FOR I = 1 TO 12
5740   Itot[I] = Itot[I]*450
5750   Sum1 = Sum1+Itot[I]
5751 NEXT I
5760 PRINT #7 USING 5900:
5765 PRINT #7 USING 5910:
5770 FOR K = 1 TO 11 | PRINT #7 USING "5D.4D,3X,S":Btot[K] | NEXT K
5775 PRINT #7 USING "1L,4X,3A,1L,5D.4D":">10",Btot[12]
5780 PRINT #7 USING 5940:Sum0,Perr
5790 Sum2 = 0
5800 Sum3 = 0
5810 FOR I = 1 TO 12
5820   Sum2 = Sum2+Btot[I]*Cmean[I]
5830   Sum3 = Sum3+Btot[I]
5840   REM (*) CONTINUE
5841 NEXT I
5850 Sum2 = Sum2/Sum3
5860 PRINT #7 USING 5960:Sum2
5870 PRINT #7 USING 5920:
5879 PRINT #7 USING 5930:
5880 FOR K = 1 TO 11 | PRINT #7 USING "9D,3X,S":Itot[K] | NEXT K
5881 PRINT #7 USING "1L,4X,3A,1L,9D":">10",Itot[12]
5890 PRINT #7 USING 5950:Sum1
5900 IMA 21,11X,"CONTOUR INTERVALS FOR RETARDANT DISTRIBUTION (GALLONS/100 SQUARE FEET) TOTAL WITHIN EACH INTERVAL"
5910 IMA 2X,"0.0-0.2     0.3-1.0     1.1-2.0  .  2.1-3.0     3.1-4.0     4.1-5.0     5.1-6.0     6.1-7.0     7.1-8.0     8.1-
5920 IMA 11,12X,"CONTOUR INTERVALS FOR RETARDANT DISTRIBUTION (SQUARE-FOOT COVERAGE ) - TOTAL WITHIN EACH INTERVAL"
5930 IMA 2X,"0.0-0.2     0.3-1.0     1.1-2.0  .  2.1-3.0     3.1-4.0     4.1-5.0     5.1-6.0     6.1-7.0     7.1-8.0     8.1-
5940 IMA 2X,"TOTAL AMOUNT OF RETARDANT ON GRID = ",7D.2D," GALLONS",10X,"PERCENT OF TOTAL = ",5D.3D
5950 IMAGE 10X,"TOTAL AREA COVERED ",11D," SQUARE FEET."
5960 IMAGE 2X,"AVERAGE PATTERN LEVEL IS ",4D.D," GALLONS PER 100 SQUARE FEET"
5970 RETURN
5980 END
5990 REM (*) SUBROUTINE PPRINT(AA)
6000 DIM T[12],D[12]
6001 DIM S$[13](132),P$[28](132)
6010 DATA 10,9,8,7,6,5,4,3,2,1,0.3,0
6020 RESTORE 6010
6030 FOR I = 1 TO 12 | READ T[I] | NEXT I
6040 DATA "  10","   9","   8","   7","   6","   5","   4","   3","   2"
6050 DATA "   1","   +","   .","    "
```

```
6060 RESTORE 6040
6070 FOR I = 1 TO 13 | READ S$[I] | NEXT I
6080 Im = 28
6090 Jm = 56
6100 Y = -15
6110 Dy = 30
6120 PRINT #7 USING 6470:Ctrl$
6121 PRINT #7 USING 6480:
6122 PRINT #7 USING 6481:
6123 PRINT #7 USING 6482:
6124 PRINT #7 USING 6483:
6125 PRINT #7 USING 6484:
6126 PRINT #7 USING 6485:
6127 PRINT #7 USING 6486:
6128 PRINT #7 USING 6487:
6129 PRINT #7 USING 6488:
6130 PRINT #7 USING 6489:
6131 PRINT #7 USING 6490:
6132 PRINT #7 USING 6491:
6133 PRINT #7 USING 6492:
6134 PRINT #7 USING 6493:
6139 PRINT #7 USING "4X,S":
6140 FOR I = 1 TO Im | PRINT #7 USING "4D,S":I | NEXT I
6141 PRINT #7 USING "3L":
6150 Jst = 0
6160 FOR J = 1 TO Jm
6170   FOR I = 1 TO Im
6180     P$[I] = S$[13]
6181   NEXT I
6190   Ist = 0
6200   FOR I = 1 TO Im
6210     FOR K = 1 TO 12
6220       IF Cd[I,J]>T[K] THEN EXIT TO 6250
6230       REM (*) CONTINUE
6231     NEXT K
6240     GOTO 6280
6250     P$[I] = S$[K]
6260     Ist = 1
6270     Jst = 1
6280     REM (*) CONTINUE
6281   NEXT I
6290   IF Jst=1 AND Ist=0 THEN EXIT TO 6330
6300   Y = Y+Dy
6310   PRI #7 USI 6510:J | FOR I1 = 1 TO Im | PRI #7 USI 6511:P$[I1] | NEX I1
6311   PRINT #7 USING 6512:Y
6320   REM (*) CONTINUE
6321 NEXT J
6330 REM (*) CONTINUE
6340 FOR I = 1 TO 12
6350   D[I] = 0
6351 NEXT I
6360 I = 14
6370 FOR J = 1 TO Jm
6380   FOR K = 1 TO 12
6390     IF Cd[I,J]>T[K] THEN D[K] = D[K]+Dy
6400     REM (*) CONTINUE
6401   NEXT K
```

```
6410   REM (*) CONTINUE
6411 NEXT J
6420 PRINT #7 USING 6520:
6430 FOR I = 1 TO 12
6440   K = 12-I+1
6450   PRINT #7 USING 6530:D[K],T[K]
6451 NEXT I
6460 RETURN
6470 IMAGE 1A
6480 IMAGE 40X,"S C A L E D   P A T T E R N   P L O T ",1L
6481 IMAGE 38X,"CELL SIZE IS 15 FEET WIDE BY 30 FEET LONG",1L
6482 IMAGE 38X," . --- 0.0 TO 0.2 GALLONS/100 SQUARE FEET"
6483 IMAGE 38X," + --- 0.3 TO 1.0 GALLONS/100 SQUARE FEET"
6484 IMAGE 38X," 1 --- 1.1 TO 2.0 GALLONS/100 SQUARE FEET"
6485 IMAGE 38X," 2 --- 2.1 TO 3.0 GALLONS/100 SQUARE FEET"
6486 IMAGE 38X," 3 --- 3.1 TO 4.0 GALLONS/100 SQUARE FEET"
6487 IMAGE 38X," 4 --- 4.1 TO 5.0 GALLONS/100 SQUARE FEET"
6488 IMAGE 38X," 5 --- 5.1 TO 6.0 GALLONS/100 SQUARE FEET"
6489 IMAGE 38X," 6 --- 6.1 TO 7.0 GALLONS/100 SQUARE FEET"
6490 IMAGE 38X," 7 --- 7.1 TO 8.0 GALLONS/100 SQUARE FEET"
6491 IMAGE 38X," 8 --- 8.1 TO 9.0 GALLONS/100 SQUARE FEET"
6492 IMAGE 38X," 9 --- 9.1 TO 10. GALLONS/100 SQUARE FEET"
6493 IMAGE 38X," 10 --- GREATER THAN 10 GALLONS/100 SQUARE FEET"
6510 IMAGE 3D,1X,S
6511 IMAGE 4A,S
6512 IMAGE 5D," FEET",4L
6520 IMAGE 48X,"PATTERN LENGTH DATA  ",1L
6530 IMAGE 35X,5D, "FEET ABOVE ",4D.D," GALLONS/100 SQUARE FEET"
6540 END
6550 REM (*) SUBROUTINE PATADD(VACI)
6551 DELETE Dst,Qo,Qdoto,Zo,Veo,Vzo ! QDOTX,TIM1,VEX
6560 DIM Tp[2000],Lcon[9],Conv[9] ! TP[13440]
6570 DIM Sing[1680]
6580 DIM Lcmax[9],Dela[9]
6590 REM (*) COMMON /ADD/NPTS,VALIN(56),ITC(8)
6600 DATA 0.5,1,2,3,4,6,8,10,12
6610 RESTORE 6600
6620 FOR I = 1 TO 9 | READ Conv[I] | NEXT I
6630 IMA 1A,36X,"MAXIMUM LINE LENGTHS WITH CORRESPONDING TANK OPENING DELAYS ",2L
6640 IMA 1L,21X,"       NO. OF ",8(2X,"---------"),1L,21X,"      TANKS  ",8("   FEET SEC")
6660 IMAGE 2X
6670 Knots = Vaci
6680 Valin[Npts+1] = 0
6690 Valin[Npts+2] = 0
6700 Jfrst = 0
6710 REM WRITE HEADINGS
6720 PRINT #7 USING 6630:Ctrl$
6729 PRINT #7 USING "34X,S":
6730 FOR I = 1 TO 8 | PRINT #7 USING "2X,3D.D,4A,S":Conv[I]," GPC" | NEXT I
6731 PRINT #7 USING 6640:
6740 Lalt = 0
6750 REM LENGTH OF SUBCELL
6760 Mcell = 5
6770 REM NUMBER OF SUBCELLS TO START
6780 Mstcl = 3
6790 REM NUMBER OF SUBCELLS TO A CELL
6800 Mlncl = 6
```

```
6810 Fps = Knots*1.68781
6820 REM DELT IS LENGTH  (SEC) OF INTERVAL
6830 Delt = 0.1
6840 Fpdel = Fps*Delt
6850 REM COMPUTE NUMBER OF CELLS PER INTERVAL
6860 Idcell = INT(Fpdel/Mcell+0.5)
6870 REM EXPAND SINGLE PATTERN
6880 Qnext = 0
6890 Lastd = 0
6900 Nextd = Mstcl
6910 Nto = Npts+2
6920 FOR I = 1 TO Nto
6930   Qlast = Qnext
6940   Qnext = Valin[I]
6950   Slope = (Qnext-Qlast)/(Nextd-Lastd)
6960   Jx = Lastd+1
6970   FOR Ix = Jx TO Nextd
6980     Sing[Ix] = Qlast+(Ix-Lastd)*Slope
6981   NEXT Ix
6990   Lastd = Nextd
7000   Nextd = Nextd+Mlncl
7001 NEXT I
7010 Lsp = INT(Npts*Mlncl+Mlncl/2)
7020 REM MAXIMUM NUMBER OF INTERVALS
7030 Nintv = INT(Lsp/Idcell+1)
7040 REM SINGLE PATTERN IS EXPANDED
7050 REM
7060 REM ROUTINE TO ADD TOGETHER PATTERNS
7070 Ntank = 0
7080 FOR Jj = 1 TO 8
7090   Ntank = Ntank+1
7100   FOR Kc = 1 TO 9
7110     Dela[Kc] = 0
7120     Lcmax[Kc] = 0
7121   NEXT Kc
7130   IF Itc[Jj]<>1 THEN 7410
7140   FOR Jr = 1 TO Nintv
7150     J = Jr-1
7160     Idisp = INT(J*Idcell)
7170     Dly = J*Delt
7180     Maxl = INT(Lsp+(Ntank-1)*Idisp)
7190     FOR K = 1 TO Maxl
7200       Tp[K] = 0
7201     NEXT K
7210     Idat = 0
7220     FOR K = 1 TO Ntank
7230       FOR Kl = 1 TO Lsp
7240         Kk = INT(Kl+Idat)
7250         Tp[Kk] = Tp[Kk]+Sing[Kl]
7251       NEXT Kl
7260       Idat = INT(Idat+Idisp)
7261     NEXT K
7270     REM ROUTINE TO COMPUTE LENGTHS
7280     FOR I = 1 TO 9
7290       Lcon[I] = 0
7291     NEXT I
7300     FOR I = 1 TO Maxl
```

```
7310       FOR J = 1 TO 9
7320         IF Tp[I]>=Conv[J] THEN Lcon[J] = INT(Lcon[J]+Mcell)
7321       NEXT J
7330       REM (*) CONTINUE
7331     NEXT I
7340     FOR K = 1 TO 9
7350       IF Lcmax[K]>=Lcon[K] THEN 7380
7360       Lcmax[K] = INT(Lcon[K])
7370       Dela[K] = Dly
7380       REM (*) CONTINUE
7381     NEXT K
7390     REM (*) CONTINUE
7391   NEXT Jr
7400   PRINT #7 USING "22X,7X,1D,4X,S":Ntank
7401   FOR I = 1 TO 8 | PRI #7 USI "2X,4D,1X,2D.D,S":Lcmax[I],Dela[I] | NEX I
7402   PRINT #7:
7410   REM (*) CONTINUE
7411 NEXT Jj
7420 REM END OF THIS ALTITUDE AND VELOCITY
7430 RETURN
7440 END
10000 Gali = A[17]
10010 Cflag = A[18]
10020 Rdqv = A[24]
10030 Convex = A[25]
10040 Bflag = A[32]
10050 Alf = A[37]
10060 K1 = A[40]
10070 K2 = A[41]
10080 Delt = A[42]
10090 Tr = A[43]
10100 Tx = A[44]
10110 Rflag = A[45]
10120 Fpat = A[46]
10130 Fran = A[47]
10140 Fcran = A[48]
10150 Vaci = A[51]
10160 Alt1 = A[52]
10170 Add = A[53]
10180 R = A[62]
10190 RETURN
20000 OPEN #5:C$,"f"
20010 WRITE #5:M,N$,K1,Vaci,Alt1,K2,Delz,Sigma,Cd,Gali
20020 CLOSE
```

APPENDIX B: SAMPLE PATSIM INPUT-OUTPUT

B-1 Sample input file

```
                                        PATSIM INPUT

17
500
18
1
51
125
52
200
45
1
53
1
1
1
0
1
0
0
0
0
24
10
0         0        0
0.1       2.68     0
0.2   7.98     0
0.3       13.22    0
0.4       23.52    0
0.5       36       0
0.6       52.22    0
0.7       68.92    0
0.8       84.68    0
0.9       100.24   0
* DEMPSAY DC-4 4" OPEN 200' 125 KT GUM
```

B-2 Sample output

```
                  S T A N O A R O   P A T T E R N   S I M U L A T I O N
                                                                         R E T A R D A N T   P A T T E R

       17   5.000000E+02
       18   1.000000E+00
       51   1.250000E+02
       52   2.000000E+02
       45   1.000000E+00
       53   1.000000E+00
       24   1.000000E+01
 QUANTITY AND OOOR ANGLE VS TIME OATA
                                      TIME-SEC        Q-GAL        ANGLE-OEG
0.00000E+00     0.00000E+00     0.00000E+00
1.00000E-01     2.68000E+00     0.00000E+00
2.00000E-01     7.98000E+00     0.00000E+00
3.00000E-01     1.32200E+01     0.00000E+00
4.00000E-01     2.35200E+01     0.00000E+00
5.00000E-01     3.60000E+01     0.00000E+00
6.00000E-01     5.22200E+01     0.00000E+00
7.00000E-01     6.89200E+01     0.00000E+00
8.00000E-01     8.46800E+01     0.00000E+00
9.0D000E-01     1.0024DE+02     0.00000E+00
         * DEMPSAY DC-4 4" OPEN 200' 125 KT GUM


        VELOCITY(KNOTS)=      125
                                          ALTITUDE(FEET)=      200
```

DETAILED PATTERN DATA

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.5	0.5	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.6	0.6	0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.5	0.9	0.9	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.7	1.1	1.1	0.7	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.7	1.1	1.1	0.7	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.1	1.1	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.1	1.1	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.0	1.0	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.8	0.8	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CONTOUR INTERVALS FOR RETARDANT DISTRIBUTION (GALLONS/100 SQUARE FEET) TOTAL WITHIN EACH INTERVAL

0.0-0.2	0.3-1.0	1.1-2.0 .	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-7.0	7.1-8.0	8.1-9.0	9.1-10
47.7202	212.1845	160.6453	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

TOTAL AMOUNT OF RETARDANT ON GRID = 420.55 GALLONS
AVERAGE PATTERN LEVEL IS 0.9 GALLONS PER 100 SQUARE FEET

CONTOUR INTERVALS FOR RETARDANT DISTRIBUTION (SQUARE-FOOT COVERAGE) - TOTAL WITHIN EACH INTERVAL

0.0-0.2	0.3-1.0	1.1-2.0 .	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-7.0	7.1-8.0	8.1-9.0	9.1-10.0
93600	47700	15300	0	0	0	0	0	0	0	0

TOTAL AREA COVERED 156600 SQUARE FEET.

S C A L E D   P A T T E R N   P L O T

CELL SIZE IS 15 FEET WIDE BY 30 FEET LONG

. --- 0.0 TO 0.2 GALLONS/100 SQUARE FEET
+ --- 0.3 TO 1.0 GALLONS/100 SQUARE FEET
1 --- 1.1 TO 2.0 GALLONS/100 SQUARE FEET
2 --- 2.1 TO 3.0 GALLONS/100 SQUARE FEET
3 --- 3.1 TO 4.0 GALLONS/100 SQUARE FEET
4 --- 4.1 TO 5.0 GALLONS/100 SQUARE FEET
5 --- 5.1 TO 6.0 GALLONS/100 SQUARE FEET
6 --- 6.1 TO 7.0 GALLONS/100 SQUARE FEET
7 --- 7.1 TO 8.0 GALLONS/100 SQUARE FEET
8 --- 8.1 TO 9.0 GALLONS/100 SQUARE FEET
9 --- 9.1 TO 10. GALLONS/100 SQUARE FEET
10 --- GREATER THAN 10 GALLONS/100 SQUARE FEET

```
     1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27  28

1                                    .   .   .   .   .   .   .   .   .   .   .   .                                 15 FEET

2                                    .   .   .   .   .   +   +   .   .   .   .   .                                 45 FEET

3                                    .   .   .   .   .   .   .   .   .   .   .   .                                 75 FEET

4                                    .   .   .   .   .   .   .   .   .   .   .   .                                105 FEET

5                                    .   .   .   .   .   +   +   .   .   .   .   .                                135 FEET

6                                    .   .   .   .   +   +   +   +   .   .   .   .                                165 FEET

7                                    .   .   .   .   +   +   +   +   .   .   .   .                                195 FEET
```

8	. . . . + + + + ...	225 FEET
9	. . . . + 1 1 + ...	255 FEET
10	. . . . + 1 1 + ...	285 FEET
11	. . . . + 1 1 + ...	315 FEET
12	. . . . + 1 1 + ...	345 FEET
13	. . . . + 1 1 + ...	375 FEET
14	. . . . + 1 1 + ...	405 FEET
15	. . . . + 1 1 + ...	435 FEET
16	. . . . + 1 1 + ...	465 FEET
17	. . . . + 1 1 + ...	495 FEET
18	. . . . + 1 1 + ...	525 FEET
19	. . . . + 1 1 + ...	555 FEET
20	. . . . + 1 1 + ...	585 FEET
21	. . . . + 1 1 + ...	615 FEET

22	.	.	.	.	+	1	1	+	.	.	.	.	645 FEET
23	.	.	.	.	+	1	1	+	.	.	.	.	675 FEET
24	.	.	.	.	+	1	1	+	.	.	.	.	705 FEET
25	.	.	.	.	+	1	1	+	.	.	.	.	735 FEET
26	.	.	.	.	+	+	+	+	.	.	.	.	765 FEET
27	.	.	.	.	+	+	+	+	.	.	.	.	795 FEET
28	.	.	.	.	+	+	+	+	.	.	.	.	825 FEET
29	.	.	.	.	.	.	.	.	.	.	.	.	855 FEET

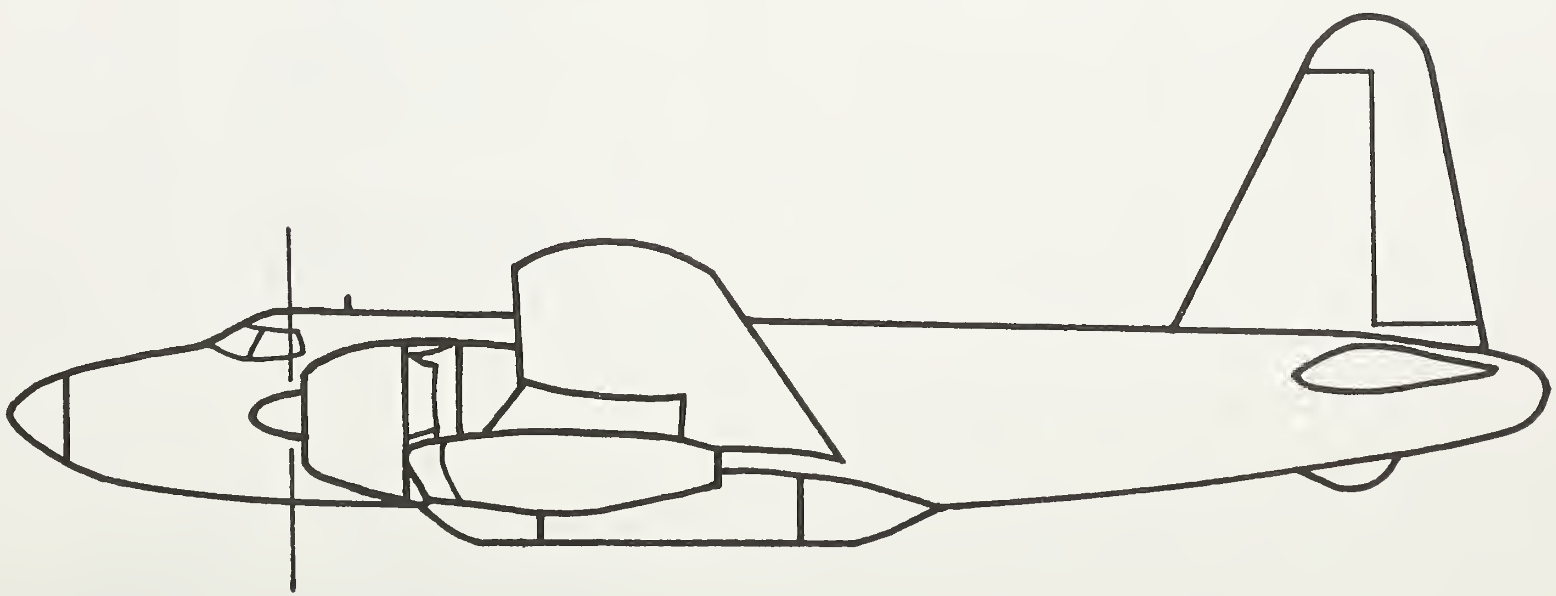
PATTERN LENGTH DATA

870FEET ABOVE 0.0 GALLONS/100 SQUARE FEET
750FEET ABOVE 0.3 GALLONS/100 SQUARE FEET
510FEET ABOVE 1.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 2.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 3.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 4.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 5.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 6.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 7.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 8.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 9.0 GALLONS/100 SQUARE FEET
0FEET ABOVE 10.0 GALLONS/100 SQUARE FEET

MAXIMUM LINE LENGTHS WITH CORRESPONDING TANK OPENING DELAYS

	0.5 GPC		1.0 GPC		2.0 GPC		3.0 GPC		4.0 GPC		6.0 GPC		8.0 GPC		10.0 GPC	
1	670	0.0	525	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2	1390	3.6	1145	3.1	525	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4	2830	3.6	2385	3.1	845	1.6	590	0.0	525	0.0	0	0.0	0	0.0	0	0.0

AIRTANKER PERFORMANCE GUIDE
for
BLACK HILLS/ROSENBALM
TANKED P2V-5 AIRCRAFT
(Tanker 07 — 2450 - Gallon Load)



Performance Guide PG-20

Compiled by: C. W. George, A. D. Blakely, and G. M. Johnson

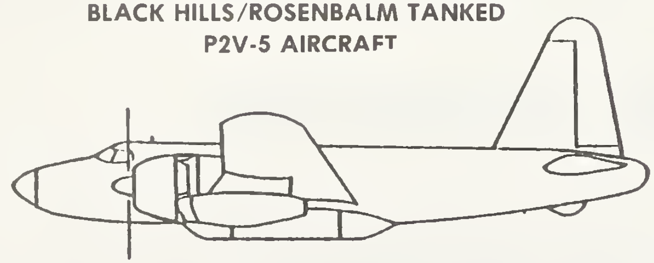
MARCH 1982

Intermountain Forest and Range Experiment Station
Forest Service, U.S. Department of Agriculture
Ogden, Utah

This manual is published as a part of a program to improve fire control technology, specifically through the use of fire retardant chemicals and delivery systems whose chemical and/or design characteristics are tailored to fuel and fire situation needs. This program is being conducted at the Northern Forest Fire Laboratory. Information or questions regarding these studies should be directed to the:

Northern Forest Fire Laboratory
Drawer G
Missoula, Montana 59806

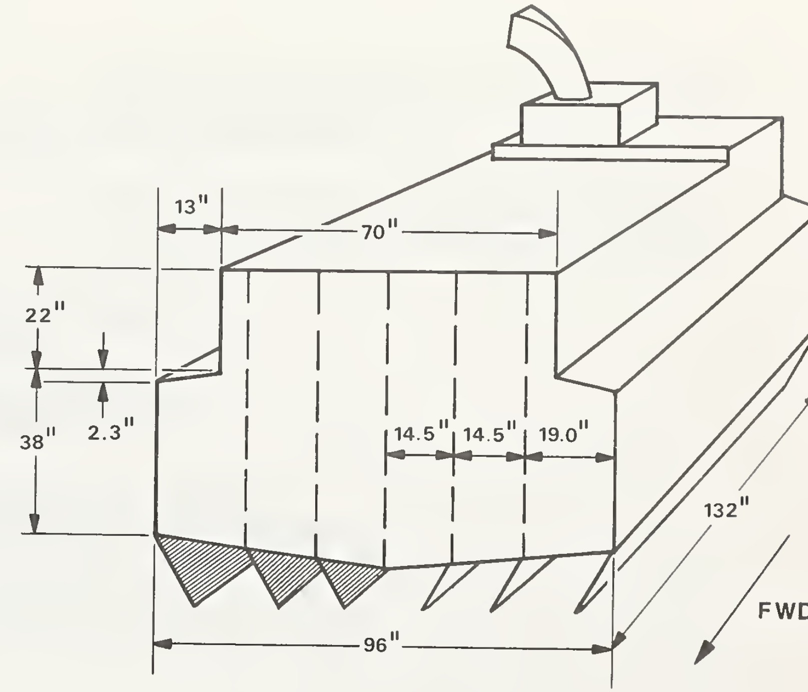
BLACK HILLS/ROSENBALM TANKED P2V-5 AIRCRAFT



The P2V-5 with the Rosenbalm designed tank carries 2450 gallons of retardant in two 442 and four 392 gallon compartments. As a result of differences in the door sizes, (outer door: 12.25 ft.^{2}, inner door: 8.75 ft.^{2}) the flow rate difference between separate compartments cause ground response patterns that preclude averaging. Therefore, throughout this guide "O" will be used to identify the outboard 442-gallon compartment and "I" the inboard 392-gallon compartments. A "+" used as "O+I" indicates compartment dropped simultaneously similarly "," as "O,I" indicates compartments released in sequence (trail drop).

The system is capable of releasing one, two, three, or size compartments simultaneously or in trail with the time interval controlled by an intervalometer or manually. The longest lengths of line at coverage levels up to 4 GPC are achieved using single sequence releases (trail drops). For higher coverage levels double or triple successive releases are applicable. The full salvo should be reserved for only the most difficult conditions (high wind, intense fire, high drop height).

The retardant mass has considerable momentum and has the capability to penetrate the fire plume in quantities adequate for direct suppression. The momentum also may uproot trees, damage ground equipment, or injure personnel. For this reason it is recommended that 3 or 6 compartment salvos not be used near ground operations.

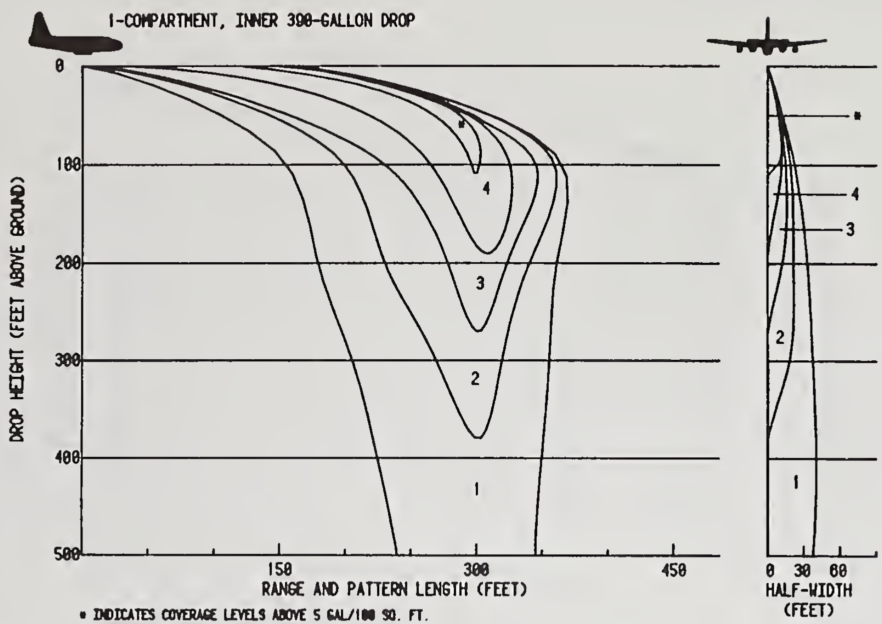


CHARACTERISTICS

Capacity	2450 Gallons		
Increment	Two 442 and Four 392 Gallon Compartments		
Compartments Released[1]	Evacuation Time (sec)	Av. Flow Rate (gallons/sec)	Peak Flow Rate (gallons/sec)
1 (I)[2]	0.70	560	700
1 (O)	0.50	880	1250
2 (I+I)	0.70	1120	1400
2 (O+I)	0.70	1180	1900
3	0.70	1750	2550
6	0.70	3500	5100

(1) Number of compartments released simultaneously.
(2) (I)=Single inner compartment release.
(O)=Single outer compartment release.
(I+I)=Double inner-inner compartment release.
(O+I)=Double outer-inner compartment release.
3 compartment release consists of 2 inner and 1 outer compartment.

Pattern Coverage Characteristics - WATER-LIKE Retardants
Fire-Trol 100, Fire-Trol 931 (LC) and Water

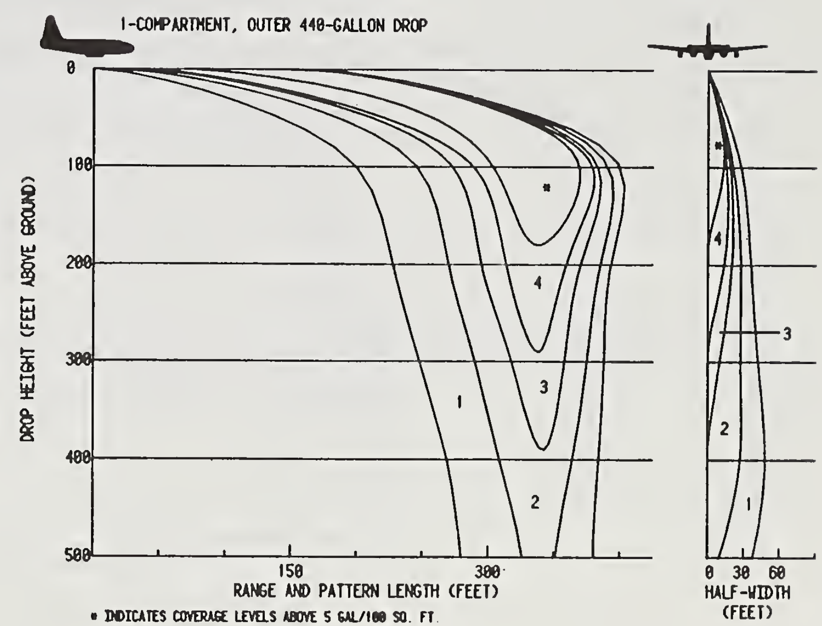


Recommended For:		
Coverage Level	Fuel Model[1] (1978 NFDRS)	Description
1	A, L, S	Annual and Perennial Western grasses: tundra
2	C, H, P, U E, R,	Tall grasses: Conifer (with grasses/forbs/needles and/or woody shrubs understory) Hardwoods (winter and summer)
3	K, F[2], N, T	Light slash (conifer or hardwood): Intermediate brush (green): Sawgrass; Western woody shrubs
4	G	Shortneedle conifer (heavy dead litter)
6	D, Q, F[2]	Southern Rough: Alaska Black Spruce, Intermediate brush (cured)
Greater than 6	B, I, J, O	California mixed chaparral; Medium and heavy slash: High Pocosin

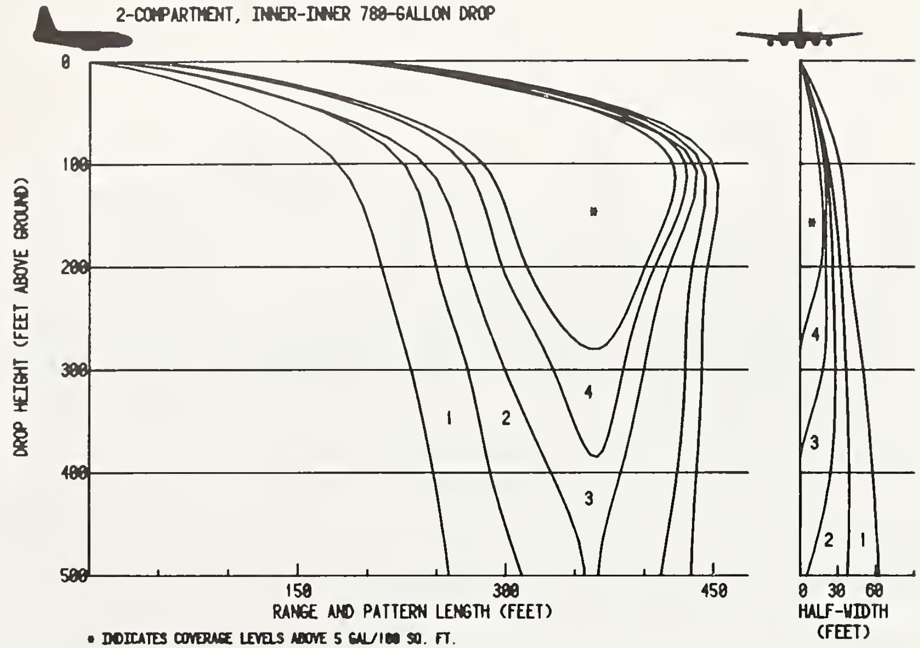
For creeping or smouldering fires, reduction of one coverage level may be considered
[1] Fuel models considered to be in flammable condition.
[2] Coverage level requirements for intermediate brush depend on its stage of curing.

USE OF PATTERN FOOTPRINTS

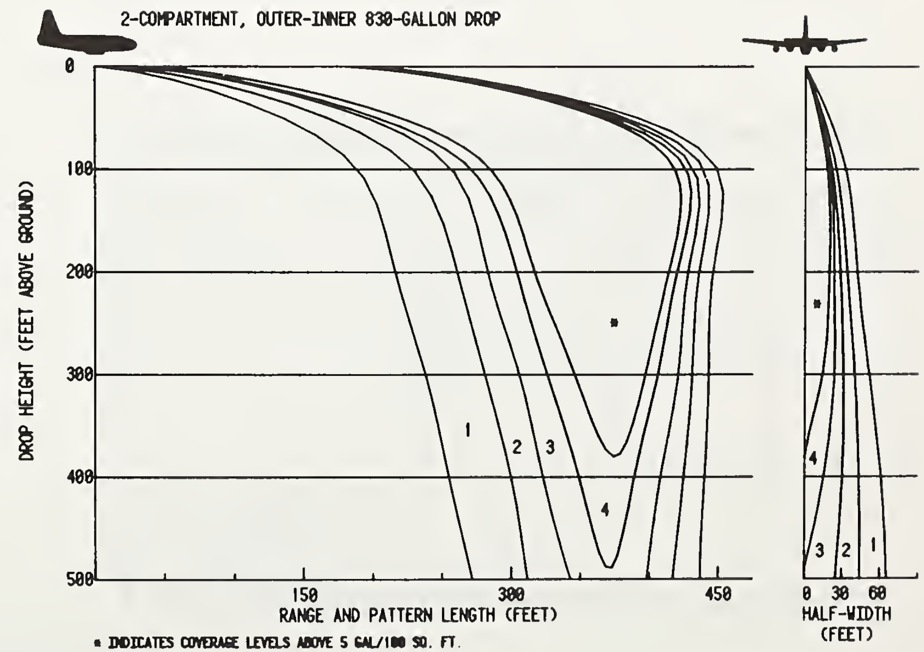
Pattern footprints provide information on aircraft capability at various coverage levels. The presentation allows estimation of ground range from point of release to the center (deepest penetration) of the pattern. It shows where pattern coverage is relatively constant with increasing altitude, useful to develop width and increase operating safety, and where small increases in altitude cause rapid decreases in some coverage levels. The footprints also indicate, by comparison, the differences in operations related to retardant type.



Pattern Coverage Characteristics - WATER-LIKE Retardants
Fire-Trol 100, Fire-Trol 931 (LC) and Water

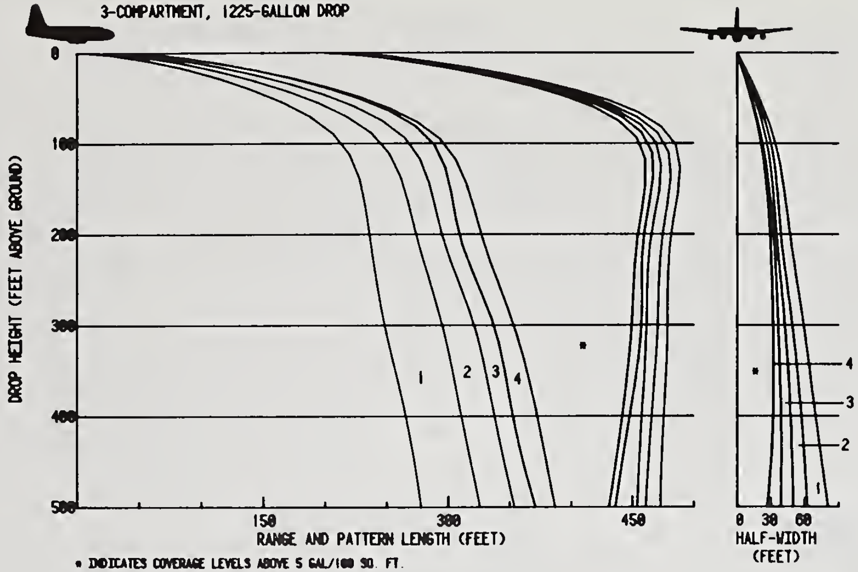


- Drop Speed: 125 knots
- Coverage levels in gallons per 100 square feet



T07(3)

Pattern Coverage Characteristics - WATER-LIKE Retardants
Fire-Trol 100, Fire-Trol 931 (LC) and Water

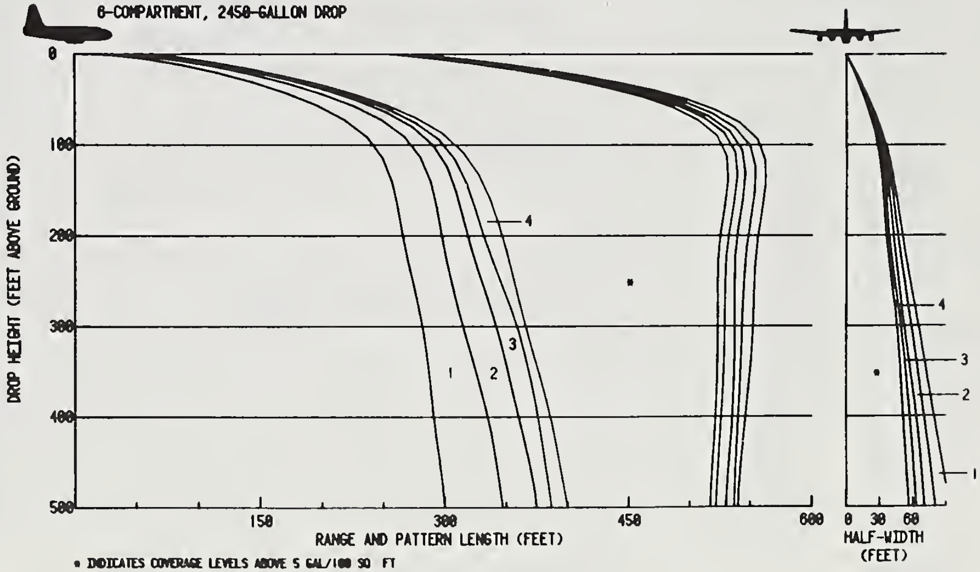


Recommended For:		
Coverage Level	Fuel Model[1] (1978 NFDRS)	Description
1	A, L, S	Annual and Perennial Western grasses; tundra
2	C, H, P, U	Tall grasses. Conifer (with grasses/forbs/needles and/or woody shrubs understory)
	E, R,	Hardwoods (winter and summer)
3	K, F[2], N, T	Light slash (conifer or hardwood). Intermediate brush (green). Sawgrass. Western woody shrubs
4	G	Shortneedle conifer (heavy dead litter)
6	D, Q, F[2]	Southern Rough. Alaska Black Spruce, Intermediate brush (cured)
Greater than 6	B, I, J, O	California mixed chaparral; Medium and heavy slash. High Pocosin

For creeping or smouldering fires reduction of one coverage level may be considered
[1] Fuel models considered to be in flammable condition
[2] Coverage level requirements for intermediate brush depend on its stage of curing

USE OF PATTERN FOOTPRINTS

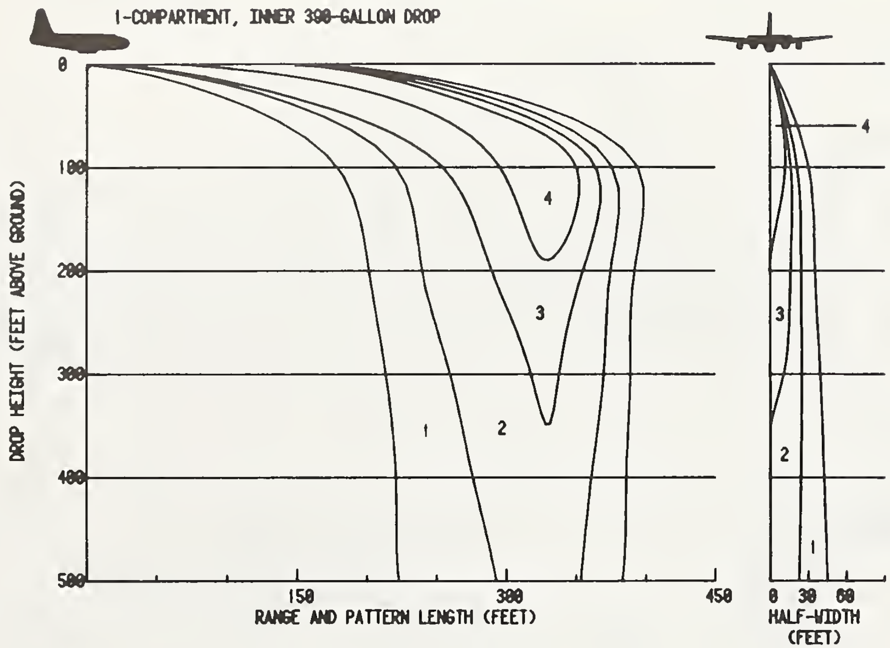
Pattern footprints provide information on aircraft capability at various coverage levels. The presentation allows estimation of ground range from point of release to the center (deepest penetration) of the pattern. It shows where pattern coverage is relatively constant with increasing altitude, useful to develop width and increase operating safety, and where small increases in altitude cause rapid decreases in some coverage levels. The footprints also indicate, by comparison, the differences in operations related to retardant type.

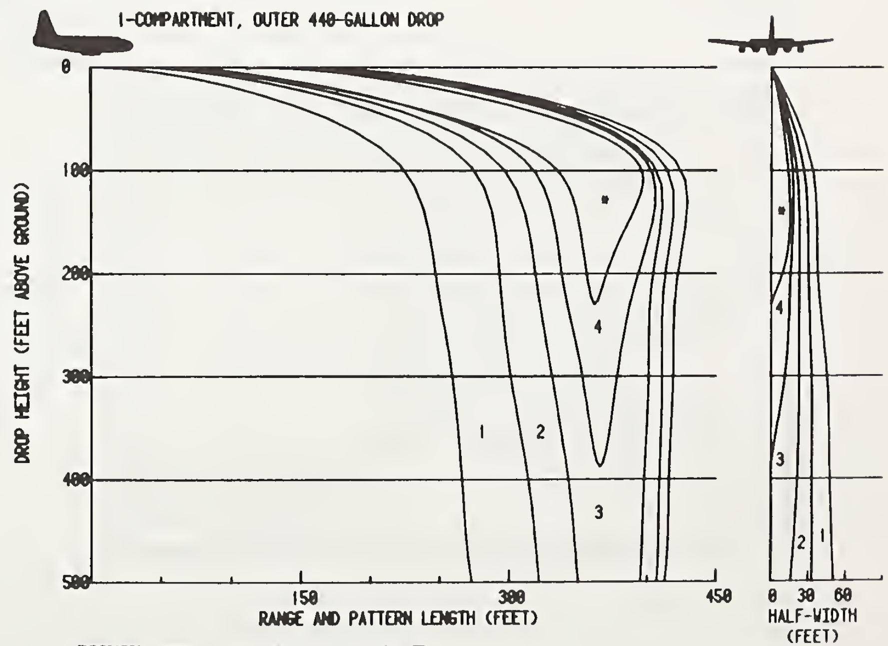


T07(4)

Pattern Coverage Characteristics - <u>GUM-THICKENED</u> Retardants
Phos-Chek XA, Gelgard and Gum-Thickened Fire-Trol 931 (LC)

- Drop speed: 125 knots
- Coverage levels in gallons per 100 square feet



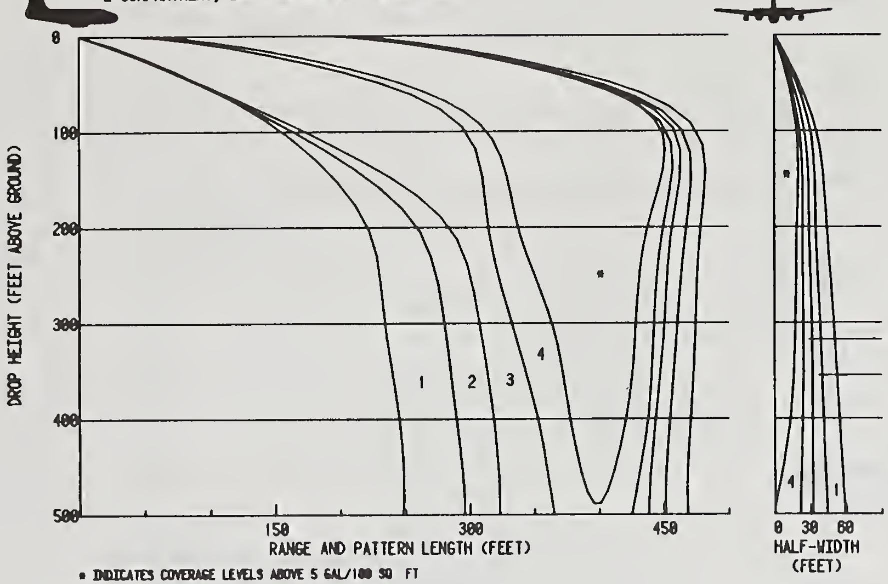


* INDICATES COVERAGE LEVELS ABOVE 5 GAL/100 SQ. FT.

T07(5)

Pattern Coverage Characteristics - GUM-THICKENED Retardants
Phos-Chek XA, Gelgard and Gum-Thickened Fire-Trol 931 (LC)

2-COMPARTMENT, INNER-INNER 780-GALLON DROP



* INDICATES COVERAGE LEVELS ABOVE 5 GAL/100 SQ FT

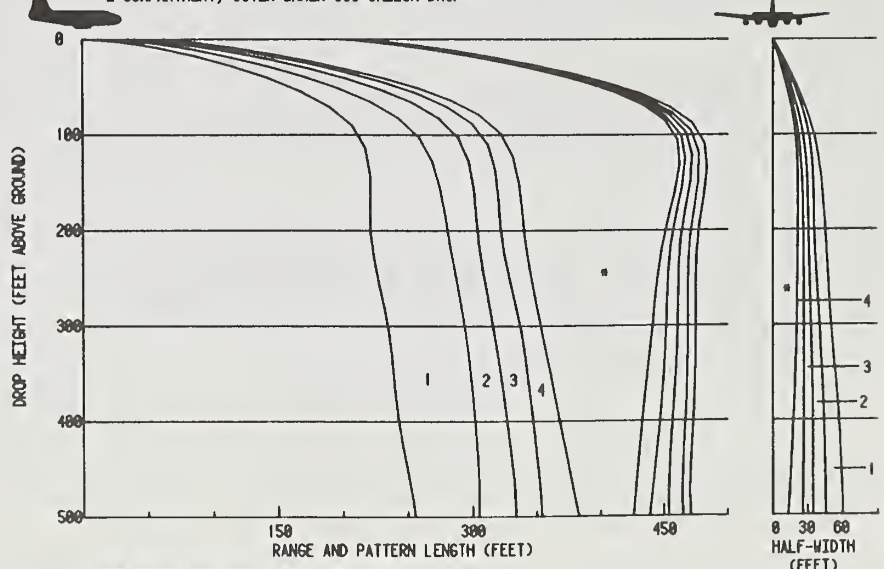
Recommended For:		
Coverage Level	Fuel Model[1] (1978 NFDRS)	Description
1	A, L, S	Annual and Perennial Western grasses; tundra
2	C, H, P, U E, R,	Tall grasses; Conifer (with grasses/forbs/needles and/or woody shrubs understory) Hardwoods (winter and summer)
3	K, F[2], N, T	Light slash (conifer or hardwood); Intermediate brush (green); Sawgrass; Western woody shrubs
4	G	Shortneedle conifer (heavy dead litter)
6	D, Q, F[2]	Southern Rough; Alaska Black Spruce, Intermediate brush (cured)
Greater than 6	B, I, J, O	California mixed chaparral; Medium and heavy slash; High Pocosin

For creeping or smouldering fires, reduction of one coverage level may be considered
[1] Fuel models considered to be in flammable condition
[2] Coverage level requirements for intermediate brush depend on its stage of curing

USE OF PATTERN FOOTPRINTS

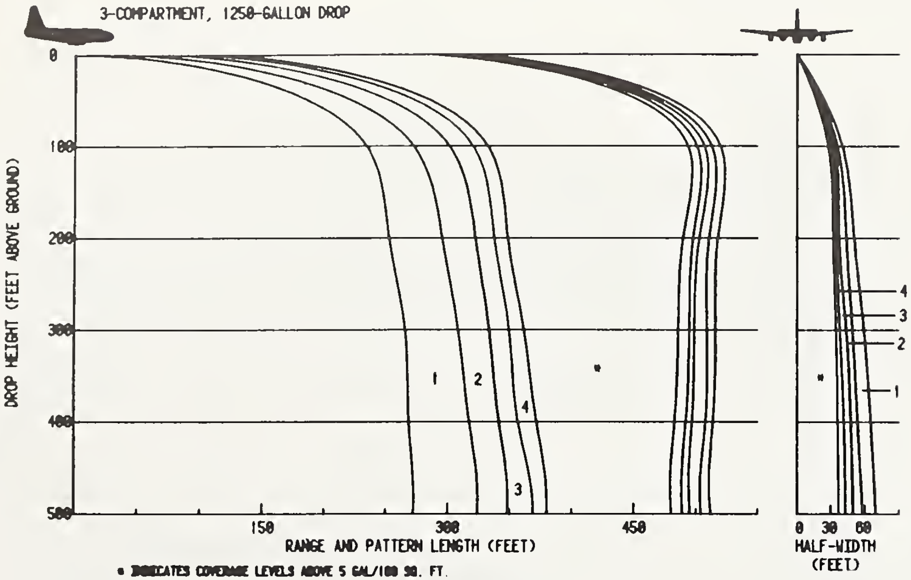
Pattern footprints provide information on aircraft capability at various coverage levels. The presentation allows estimation of ground range from point of release to the center (deepest penetration) of the pattern. It shows where pattern coverage is relatively constant with increasing altitude, useful to develop width and increase operating safety, and where small increases in altitude cause rapid decreases in some coverage levels. The footprints also indicate, by comparison, the differences in operations related to retardant type.

2-COMPARTMENT, OUTER-INNER 830-GALLON DROP

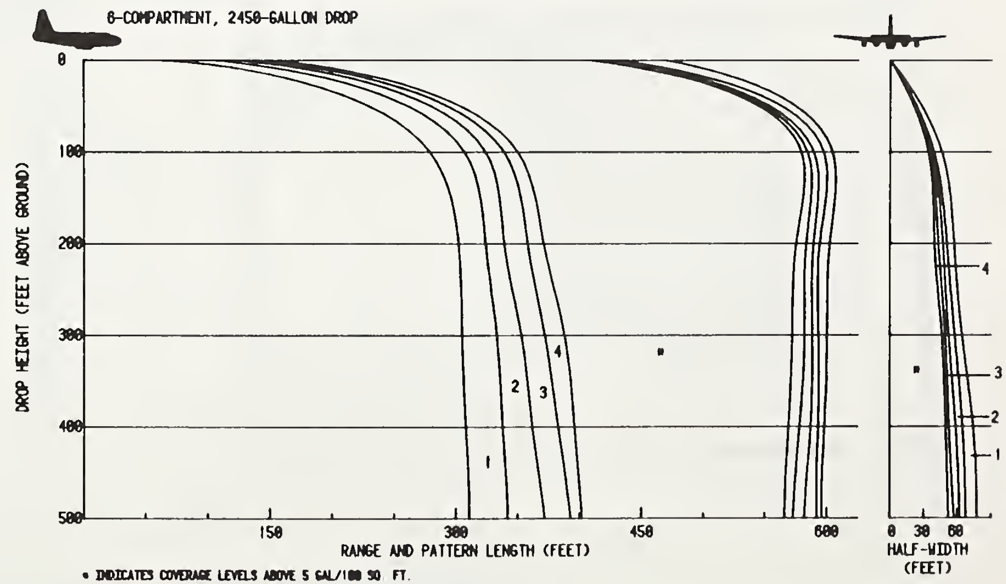


* INDICATES COVERAGE LEVELS ABOVE 5 GAL/100 SQ. FT.

Pattern Coverage Characteristics - GUM-THICKENED Retardants
Phos-Chek XA, Gelgard and Gum-Thickened Fire-Trol 931 (LC)

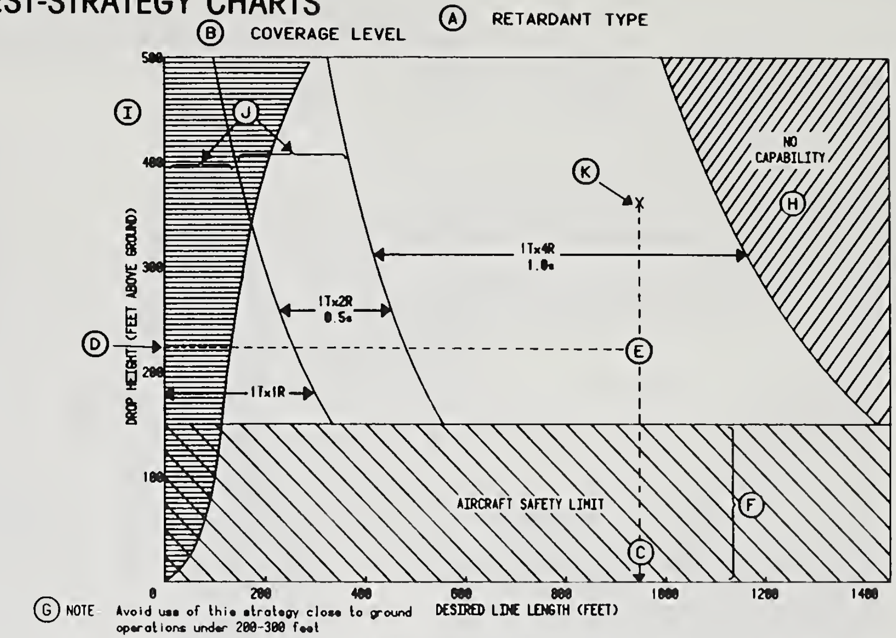


- Drop speed: 125 knots
- Coverage levels in gallons per 100 square feet



Next page is T07(9)

USE OF THE BEST-STRATEGY CHARTS



(A) Select the charts for the retardant type to be employed in the operations. This will be GUM-THICKENED (such as Phos-Chek) or WATER-LIKE (such as Fire-Trol 100).

(B) Select the chart for the appropriate coverage level for fuel and fire situations in the area of operations.

Recommended For:		
Coverage Level	Fuel Model[1] (1978 NFDRS)	Description
1	A, L, S	Annual and Perennial Western grasses: tundra
2	C, H, P, U E, R,	Tall grasses: Conifer (with grasses/forbs/needles and/or woody shrubs understory) Hardwoods (winter and summer)
3	K, F[2], N, T	Light slash (conifer or hardwood): Intermediate brush (green): Sawgrass; Western woody shrubs
4	G	Shortneedle conifer (heavy dead litter)
6	D, Q, F[2]	Southern Rough: Alaska Black Spruce, Intermediate brush (cured)
Greater than 6	B, I, J, O	California mixed chaparral; Medium and heavy slash: High Pocosin

For creeping or smouldering fires reduction of one coverage level may be considered
[1] Fuel models considered to be in flammable condition
[2] Coverage level requirements for intermediate brush depend on its stage of curing

(C) Estimate the length of line required for a particular drop at the selected coverage level.

(D) Determine drop-height limits: (1) to assure aircraft safety in clearance of terrain features both before and after the planned release and (2) to protect ground personnel in close-support operations.

(E) Identify the region on the chart defined by the line-length, drop-height condition. This will identify the best release strategy to achieve the required coverage:

2T x 2R

1.2s

The number of tank compartments to be released at one time

The number of successive releases

The approximate interval between releases in seconds

(F) SAFETY LIMIT -- Usually expressed as a fuel clearance distance; will normally be at 150 feet above ground or greater depending on terrain or fuel features

(G) NOTES -- Indicate altitude limits for high-momentum drops potentially dangerous to ground personnel when used in close support or call out other recommendations or limitations for a particular strategy.

(H) LIMITS OF CAPABILITY -- The aircraft cannot produce, in a single pass, line-length greater than that defined by the limit curve.

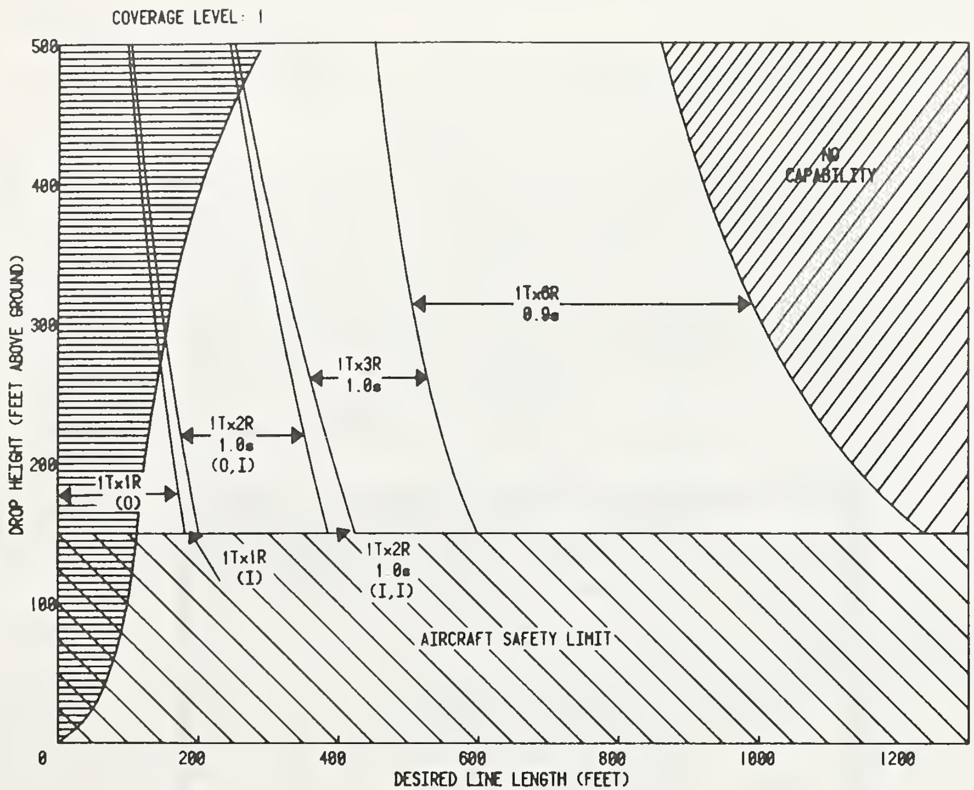
(I) REGION OF LIMITED ACCURACY -- The ability to place a pattern of the specified coverage level on a spot fire is doubtful if operations must be conducted in this region.

(J) OPERATING REGIONS -- Most efficient use of the available retardant and pattern controls will occur for the strategy listed. For more precise intervalometer settings see the detailed tables.

(K) If the desired drop is well within the line-building capability of the release strategy, consider flying higher. This will result in a wider pattern and increased safety.

T07(9)

Best Release Strategy - WATER-LIKE Retardants
Fire-Trol 100, Fire-Trol 931 (LC) and Water

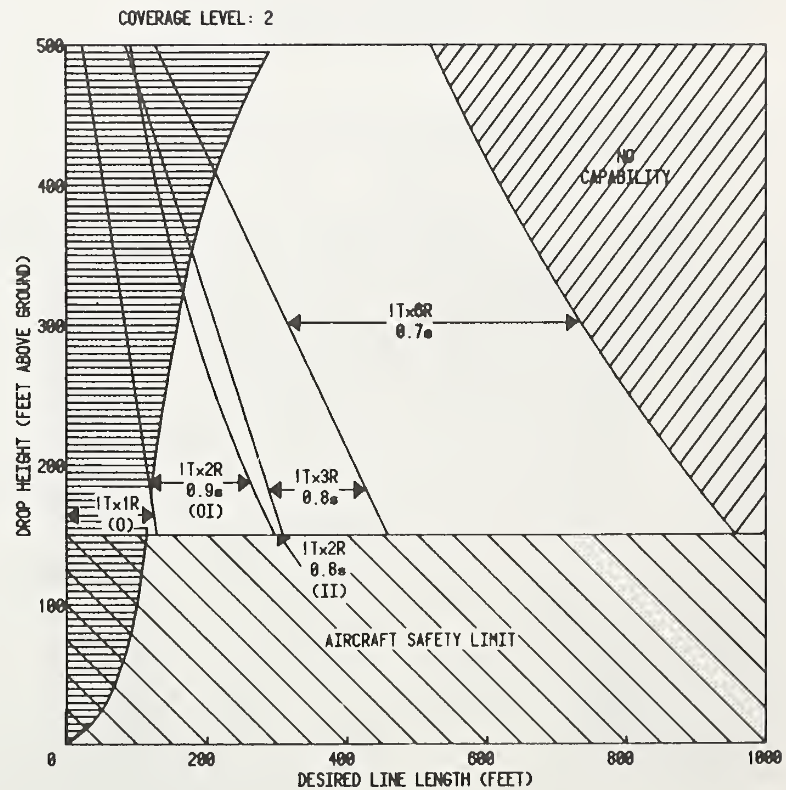


T = Tank compartments released at one time

R = Successive releases

s = seconds between successive releases

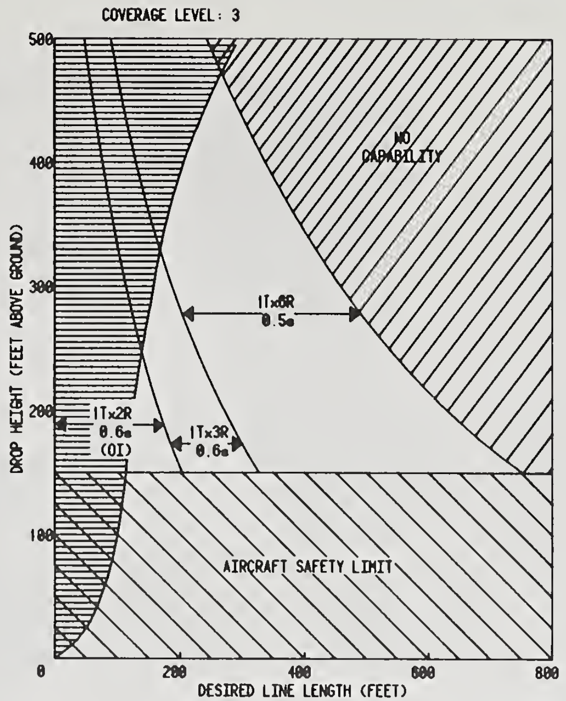
= Region of limited accuracy in direct attack



NOTES: (1) Avoid one-compartment release close to ground operations under 180 feet.
(2) Avoid two-compartment release close to ground operations under 200 feet.
(3) Avoid three-compartment release close to ground operations under 220 feet.
(4) Avoid six-compartment release close to ground operations under 280 feet.

T07(10)

Best Release Strategy - WATER-LIKE Retardants
Fire-Trol 100, Fire-Trol 931 (LC) and Water



T = Tank compartments released at one time

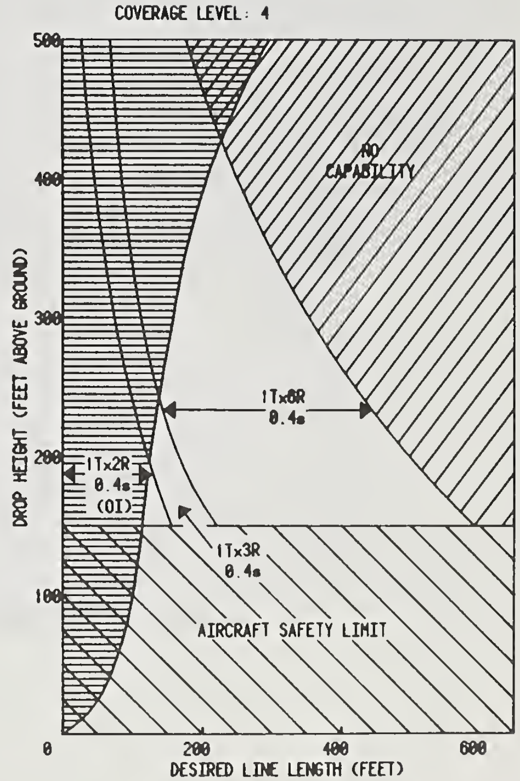
R = Successive releases

s = seconds between successive releases

= Region of limited accuracy in direct attack

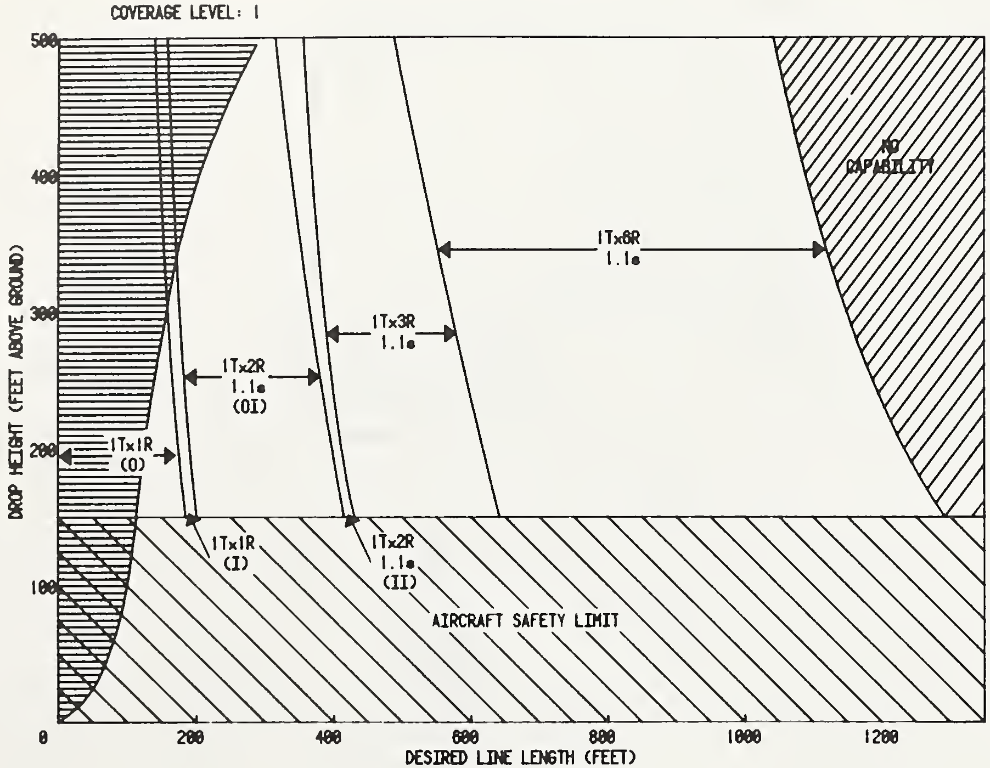
Recommended For:		
Coverage Level	Fuel Model[1] (1978 NFDRS)	Description
1	A, L, S	Annual and Perennial Western grasses; tundra
2	C, H, P, U E, R,	Tall grasses; Conifer (with grasses/forbs/needles and/or woody shrubs understory) Hardwoods (winter and summer)
3	K, F[2], N, T	Light slash (conifer or hardwood); Intermediate brush (green); Sawgrass; Western woody shrubs
4	G	Shortneedle conifer (heavy dead litter)
6	D, Q, F[2]	Southern Rough; Alaska Black Spruce, Intermediate brush (cured)
Greater than 6	B, I, J, O	California mixed chaparral; Medium and heavy slash; High Pocosin

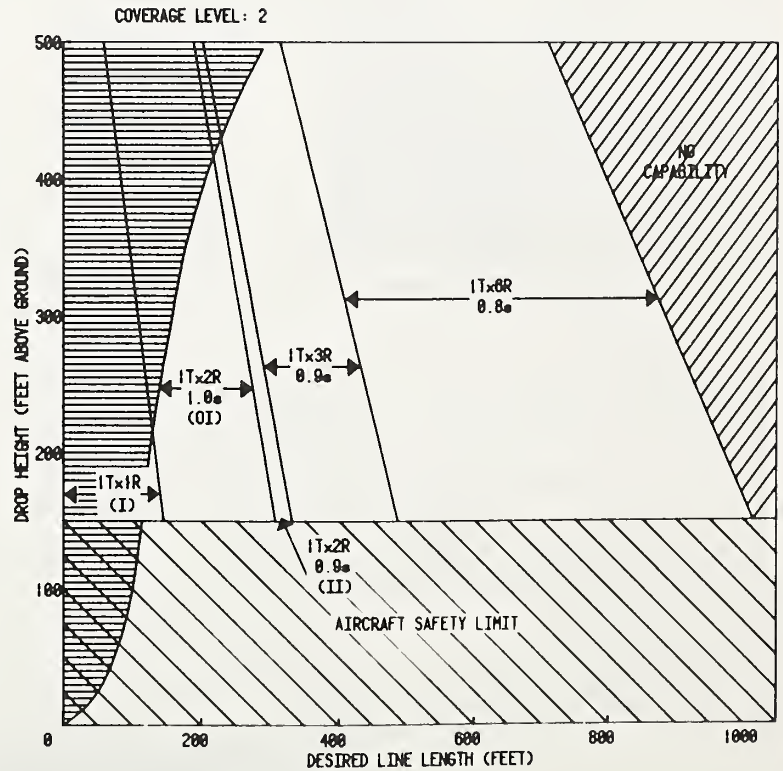
For creeping or smouldering fires reduction of one coverage level may be considered
[1] Fuel models considered to be in flammable condition
[2] Coverage level requirements for intermediate brush depend on its stage of curing



T07(11)

Best Release Strategy - GUM-THICKENED Retardants
Phos-Chek XA, Gelgard and Gum-Thickened Fire-Trol 931 (LC)





T = Tank compartments released at one time

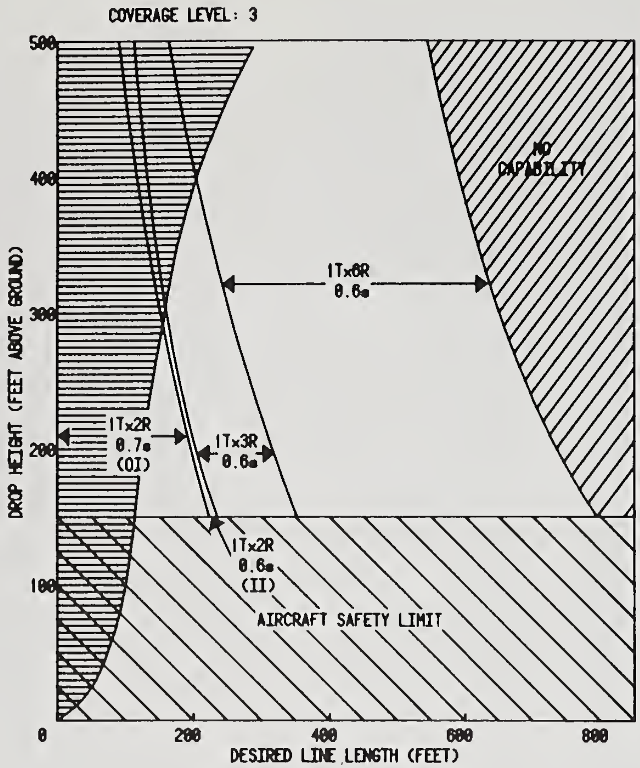
R = Successive releases

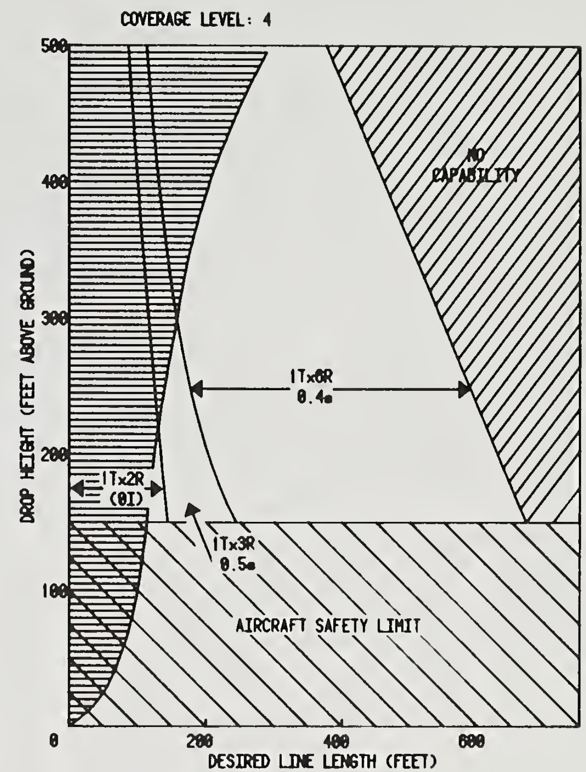
s = seconds between successive releases

= Region of limited accuracy in direct attack

T07(12)

Best Release Strategy - GUM-THICKENED Retardants
Phos-Chek XA, Gelgard and Gum-Thickened Fire-Trol 931 (LC)





NOTES: (1) Avoid one-compartment release close to ground operations under 180 feet.
(2) Avoid two-compartment release close to ground operations under 200 feet.
(3) Avoid three-compartment release close to ground operations under 220 feet.
(4) Avoid six-compartment release close to ground operations under 280 feet.

T07(13)

Maximum Line Lengths/Tank-Opening Delays - WATER-LIKE Retardants
Fire-Trol 100, Fire-Trol 931 (LC) and Water

			LEVEL 1				LEVEL 2		LEVEL 3		LEVEL 4							
			COVERAGE (GALLONS/100 SQ.FT.)															
			0.5		1.0		2.0		3.0		4.0		6.0		8.0		10.0	
COMPARTMENTS RELEASED AT A TIME	DROP HT FT	NO. OF PATTERNS	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)
ONE OUTER (O)	100	1	275	0.0	200	0.0	145	0.0	110	0.0	90	0.0	40	0.0	0	0.0	0	0.0
	200	1	225	0.0	165	0.0	115	0.0	75	0.0	45	0.0	0	0.0	0	0.0	0	0.0
	300	1	195	0.0	140	0.0	85	0.0	40	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	400	1	170	0.0	115	0.0	55	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	500	1	150	0.0	100	0.0	25	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ONE INNER (I)	100	1	275	0.0	200	0.0	160	0.0	115	0.0	60	0.0	0	0.0	0	0.0	0	0.0
	200	1	240	0.0	185	0.0	110	0.0	45	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	300	1	215	0.0	150	0.0	50	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	400	1	190	0.0	125	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	500	1	175	0.0	105	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1x2 (O,I)	100	2	550	1.4	410	1.1	340	1.0	255	0.9	200	0.7	115	0.4	85	0.3	45	0.0
	200	2	465	1.3	360	1.0	250	0.9	165	0.6	120	0.4	75	0.3	15	0.1	0	0.0
	300	2	410	1.1	320	1.0	180	0.7	115	0.4	70	0.3	5	0.1	0	0.0	0	0.0
	400	2	375	1.1	280	0.9	130	0.6	75	0.3	45	0.1	0	0.0	0	0.0	0	0.0
	500	2	345	1.0	245	0.9	90	0.4	45	0.1	0	0.0	0	0.0	0	0.0	0	0.0
1x2 (I,I)	100	2	555	1.4	455	1.2	340	1.0	285	0.8	205	0.6	115	0.0	65	0.0	5	0.0
	200	2	500	1.3	395	1.1	275	0.8	175	0.6	110	0.0	55	0.0	0	0.0	0	0.0
	300	2	450	1.2	340	1.0	210	0.6	100	0.0	50	0.0	0	0.0	0	0.0	0	0.0
	400	2	410	1.1	295	0.8	135	0.0	50	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	500	2	370	1.0	250	0.7	100	0.0	10	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	100	3	820	1.4	655	1.1	505	0.9	390	0.8	325	0.6	165	0.4	120	0.0	100	0.0
		6	1675	1.3	1385	1.1	1035	0.9	895	0.7	705	0.6	500	0.4	270	0.3	160	0.0
	200	3	735	1.3	560	1.0	410	0.8	270	0.6	165	0.4	110	0.0	85	0.0	60	0.0
		6	1500	1.3	1135	0.9	865	0.7	615	0.5	500	0.4	250	0.3	175	0.1	120	0.0
ONE	300	3	655	1.1	510	0.9	315	0.6	185	0.4	120	0.0	80	0.0	45	0.0	0	0.0
		6	1325	1.1	1005	0.9	725	0.6	440	0.4	350	0.3	165	0.1	120	0.0	115	0.0
(ALL COMB)	400	3	585	1.1	475	0.8	220	0.6	130	0.3	95	0.0	45	0.0	0	0.0	0	0.0
		6	1175	1.0	920	0.7	605	0.5	320	0.3	250	0.2	120	0.0	95	0.0	100	0.0
	500	3	520	0.9	455	0.8	135	0.0	100	0.0	65	0.0	0	0.0	0	0.0	0	0.0
		6	1040	0.9	860	0.8	505	0.4	225	0.1	175	0.1	100	0.0	70	0.0	40	0.0
TWO (O+I)	100	1	290	0.0	260	0.0	210	0.0	175	0.0	155	0.0	115	0.0	85	0.0	45	0.0
	200	1	270	0.0	230	0.0	175	0.0	145	0.0	115	0.0	75	0.0	0	0.0	0	0.0
	300	1	255	0.0	205	0.0	150	0.0	115	0.0	80	0.0	0	0.0	0	0.0	0	0.0
	400	1	235	0.0	185	0.0	125	0.0	85	0.0	40	0.0	0	0.0	0	0.0	0	0.0
	500	1	220	0.0	165	0.0	105	0.0	55	0.0	0	0.0	0	0.0	0	0.0	0	0.0
TWO (I+I)	100	1	305	0.0	270	0.0	215	0.0	195	0.0	160	0.0	115	0.0	65	0.0	0	0.0
	200	1	285	0.0	235	0.0	185	0.0	145	0.0	110	0.0	55	0.0	0	0.0	0	0.0
	300	1	265	0.0	210	0.0	155	0.0	100	0.0	50	0.0	0	0.0	0	0.0	0	0.0
	400	1	250	0.0	190	0.0	135	0.0	50	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	500	1	235	0.0	175	0.0	100	0.0	10	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	100	2	635	1.6	530	1.3	450	1.1	360	0.9	340	0.9	265	0.7	200	0.6	145	0.4
		3	965	1.6	795	1.3	700	1.1	540	0.9	510	0.9	420	0.7	340	0.6	255	0.4
	200	2	560	1.4	480	1.1	380	0.9	305	0.7	255	0.7	170	0.4	115	0.4	90	0.3
		3	850	1.4	725	1.1	575	0.9	470	0.7	425	0.7	280	0.4	225	0.4	165	0.3
TWO	300	2	520	1.3	435	1.1	320	0.9	250	0.7	185	0.6	115	0.3	60	0.3	35	0.0
		3	785	1.3	660	1.1	485	0.9	400	0.7	340	0.6	195	0.3	145	0.3	115	0.0
(ALL COMB)	400	2	485	1.1	390	0.9	270	0.6	200	0.6	135	0.4	75	0.1	25	0.0	0	0.0
		3	735	1.1	590	0.9	420	0.6	335	0.6	255	0.4	140	0.1	95	0.0	100	0.0
	500	2	465	1.1	340	0.9	230	0.6	145	0.4	100	0.3	45	0.0	0	0.0	0	0.0
		3	700	1.1	520	0.9	370	0.6	265	0.4	170	0.3	90	0.0	70	0.0	40	0.0
	100	1	300	0.0	270	0.0	230	0.0	200	0.0	175	0.0	145	0.0	120	0.0	100	0.0
		2	630	1.7	550	1.4	480	1.2	435	1.1	380	1.0	305	0.8	275	0.7	235	0.7
	200	1	280	0.0	245	0.0	200	0.0	170	0.0	150	0.0	110	0.0	85	0.0	60	0.0
		2	570	1.5	515	1.3	425	1.1	350	0.9	315	0.9	255	0.7	200	0.6	165	0.5
THREE	300	1	265	0.0	230	0.0	175	0.0	140	0.0	120	0.0	80	0.0	45	0.0	0	0.0
		2	540	1.5	475	1.2	375	1.0	300	0.8	265	0.7	205	0.6	145	0.5	120	0.0
(ALL COMB)	400	1	250	0.0	210	0.0	155	0.0	120	0.0	95	0.0	45	0.0	0	0.0	0	0.0
		2	515	1.3	440	1.1	330	0.9	265	0.7	220	0.6	155	0.5	105	0.2	100	0.0
	500	1	235	0.0	195	0.0	135	0.0	100	0.0	65	0.0	0	0.0	0	0.0	0	0.0
		2	495	1.3	400	1.0	290	0.8	235	0.6	185	0.5	105	0.2	75	0.2	40	0.0
SIX (ALL COMB)	100	1	530	0.0	315	0.0	275	0.0	250	0.0	235	0.0	200	0.0	170	0.0	160	0.0
	200	1	340	0.0	290	0.0	250	0.0	220	0.0	200	0.0	170	0.0	145	0.0	130	0.0
	300	1	305	0.0	270	0.0	225	0.0	195	0.0	170	0.0	140	0.0	120	0.0	115	0.0
	400	1	290	0.0	255	0.0	205	0.0	175	0.0	150	0.0	120	0.0	95	0.0	100	0.0
	500	1	280	0.0	240	0.0	190	0.0	155	0.0	135	0.0	100	0.0	70	0.0	40	0.0

T07(14)

Maximum Line Lengths/Tank-Opening Delays - GUM-THICKENED Retardants
Phos-Chek XA, Geigard and Gum-Thickened Fire-Trol 931 (LC)

			LEVEL 1				LEVEL 2		LEVEL 3		LEVEL 4							
			COVERAGE (GALLONS/100 SQ.FT.)															
			0.5		1.0		2.0		3.0		4.0		6.0		8.0		10.0	
COMPARTMENTS RELEASED AT A TIME	DROP HT FT	NO. OF PATTERNS	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)	MAX LENGTH (FT)	DELAY (SEC)
ONE OUTER (O)	100	1	285	0.0	200	0.0	145	0.0	110	0.0	90	0.0	40	0.0	0	0.0	0	0.0
	200	1	260	0.0	175	0.0	120	0.0	85	0.0	55	0.0	0	0.0	0	0.0	0	0.0
	300	1	240	0.0	160	0.0	110	0.0	70	0.0	25	0.0	0	0.0	0	0.0	0	0.0
	400	1	220	0.0	150	0.0	95	0.0	55	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	500	1	200	0.0	140	0.0	85	0.0	45	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ONE INNER (I)	100	1	280	0.0	215	0.0	160	0.0	115	0.0	60	0.0	0	0.0	0	0.0	0	0.0
	200	1	260	0.0	190	0.0	135	0.0	65	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	300	1	245	0.0	175	0.0	110	0.0	20	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	400	1	230	0.0	165	0.0	85	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	500	1	215	0.0	160	0.0	60	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1x2 (O,I)	100	2	550	1.4	435	1.3	340	1.0	255	0.9	200	0.7	120	0.3	85	0.0	45	0.0
	200	2	525	1.4	400	1.1	290	1.0	195	0.7	135	0.4	85	0.3	20	0.0	0	0.0
	300	2	490	1.3	365	1.1	255	0.9	150	0.6	115	4.0	55	0.1	0	0.0	0	0.0
	400	2	460	1.3	340	1.0	225	0.7	130	0.6	100	0.3	30	0.1	0	0.0	0	0.0
	500	2	435	1.3	315	1.0	190	0.7	120	0.6	85	0.4	0	0.0	0	0.0	0	0.0
1x2 (I,I)	100	2	570	1.5	460	1.2	350	1.0	285	0.8	205	0.6	115	0.0	65	0.0	5	0.0
	200	2	535	1.4	410	1.1	315	0.9	205	0.6	140	0.0	65	0.0	0	0.0	0	0.0
	300	2	505	1.3	385	1.0	275	0.8	160	0.5	110	0.0	25	0.0	0	0.0	0	0.0
	400	2	475	1.3	370	1.0	240	0.7	130	0.0	85	0.0	0	0.0	0	0.0	0	0.0
	500	2	450	1.2	360	1.0	205	0.6	115	0.0	60	0.0	0	0.0	0	0.0	0	0.0
	100	3	825	1.4	665	1.2	510	0.9	395	0.8	325	0.6	165	0.3	125	0.1	100	0.0
		6	1675	1.3	1385	1.1	1060	0.9	895	0.7	715	0.6	545	0.3	295	0.1	175	0.1
	200	3	785	1.4	620	1.1	460	0.9	315	0.6	205	0.4	125	0.0	95	0.0	70	0.0
		6	1540	1.3	1235	1.1	970	0.8	735	0.6	630	0.5	300	0.3	190	0.1	140	0.0
ONE	300	3	745	1.2	570	1.1	410	0.8	255	0.5	155	0.5	105	0.0	75	0.0	45	0.0
		6	1470	1.1	1150	1.0	880	0.7	650	0.5	545	0.5	215	0.1	190	0.1	120	0.0
(ALL COMB)	400	3	705	1.2	530	0.9	365	0.7	205	0.5	135	0.0	90	0.0	60	0.0	20	0.0
		6	1425	1.1	1090	0.9	795	0.7	590	0.5	460	0.4	175	0.1	140	0.0	115	0.0
	500	3	665	1.2	490	0.9	315	0.6	165	0.5	120	0.0	80	0.0	45	0.0	0	0.0
		6	1390	1.1	1045	0.9	705	0.6	545	0.4	375	0.3	150	0.1	120	0.0	100	0.0
TWO (O+I)	100	1	310	0.0	265	0.0	215	0.0	180	0.0	155	0.0	120	0.0	85	0.0	45	0.0
	200	1	290	0.0	255	0.0	190	0.0	160	0.0	135	0.0	85	0.0	20	0.0	0	0.0
	300	1	280	0.0	240	0.0	175	0.0	145	0.0	115	0.0	55	0.0	0	0.0	0	0.0
	400	1	275	0.0	230	0.0	165	0.0	130	0.0	100	0.0	0	0.0	0	0.0	0	0.0
	500	1	270	0.0	215	0.0	160	0.0	120	0.0	85	0.0	0	0.0	0	0.0	0	0.0
TWO (I+I)	100	1	335	0.0	320	0.0	300	0.0	285	0.0	160	0.0	115	0.0	65	0.0	5	0.0
	200	1	300	0.0	260	0.0	210	0.0	175	0.0	140	0.0	65	0.0	0	0.0	0	0.0
	300	1	290	0.0	240	0.0	180	0.0	140	0.0	110	0.0	25	0.0	0	0.0	0	0.0
	400	1	280	0.0	225	0.0	165	0.0	130	0.0	85	0.0	0	0.0	0	0.0	0	0.0
	500	1	275	0.0	220	0.0	155	0.0	115	0.0	60	0.0	0	0.0	0	0.0	0	0.0
	100	2	640	1.6	565	1.4	465	1.1	385	1.0	340	0.9	265	0.7	200	0.6	145	0.6
		3	975	1.6	870	1.4	705	1.1	580	0.9	515	0.9	435	0.7	340	0.6	305	0.6
	200	2	605	1.6	525	1.3	410	1.0	345	0.9	285	0.7	200	0.6	150	0.4	95	0.3
		3	925	1.6	800	1.3	615	1.0	515	0.9	455	0.7	335	0.6	245	0.4	180	0.3
TWO	300	2	590	1.4	500	1.3	375	1.0	310	0.9	255	0.7	160	0.4	120	0.3	75	0.1
		3	900	1.4	760	1.3	570	0.9	475	0.8	405	0.7	275	0.4	190	0.3	135	0.1
(ALL COMB)	400	2	575	1.4	480	1.1	350	0.9	285	0.7	225	0.6	130	0.4	90	0.3	55	0.0
		3	880	1.4	730	1.1	540	0.9	450	0.7	370	0.6	230	0.4	155	0.3	115	0.0
	500	2	565	1.4	465	1.1	335	0.9	260	0.7	205	0.6	110	0.3	65	0.1	35	0.0
		3	865	1.4	710	1.1	515	0.9	425	0.7	335	0.6	200	0.3	130	0.1	100	0.0
	100	1	330	0.0	285	0.0	240	0.0	205	0.0	180	0.0	145	0.0	120	0.0	100	0.0
		2	660	1.7	570	1.5	515	1.3	450	1.2	385	1.0	315	0.9	275	0.7	235	0.7
	200	1	310	1.0	265	0.0	215	0.0	180	0.0	160	0.0	125	0.0	95	0.0	70	0.0
		2	625	1.6	555	1.4	460	1.2	395	1.0	340	0.9	285	0.8	225	0.6	195	0.6
THREE	300	1	295	1.0	250	0.0	200	0.0	165	0.0	145	0.0	105	0.0	75	0.0	45	0.0
		2	605	1.6	535	1.4	430	1.1	365	1.0	315	0.9	255	0.7	195	0.6	160	0.5
(ALL COMB)	400	1	290	0.0	245	0.0	190	0.0	155	0.0	135	0.0	90	0.0	60	0.0	20	0.0
		2	595	1.6	520	1.4	410	1.1	345	0.9	295	0.8	225	0.6	170	0.5	130	0.4
	500	1	280	0.0	240	0.0	180	0.0	150	0.0	120	0.0	80	0.0	45	0.0	0	0.0
		2	585	1.5	500	1.3	390	1.0	325	0.9	280	0.8	205	0.6	155	0.5	100	0.0
SIX (ALL COMB)	100	1	545	0.0	325	0.0	290	0.0	265	0.0	245	0.0	210	0.0	180	0.0	160	0.0
	200	1	370	0.0	300	0.0	270	0.0	250	0.0	225	0.0	185	0.0	155	0.0	140	0.0
	300	1	335	0.0	295	0.0	260	0.0	235	0.0	210	0.0	165	0.0	140	0.0	120	0.0
	400	1	320	0.0	290	0.0	255	0.0	225	0.0	195	0.0	155	0.0	130	0.0	115	0.0
	500	1	310	0.0	285	0.0	250	0.0	210	0.0	180	0.0	145	0.0	120	0.0	100	0.0

NOTE: Delivery below 150 feet is not recommended! Line-length policies for these guides were generated at a lower limit of 100 feet for engineering purposes in developing footprints and Best Strategy charts. They are presented here for information only. Line lengths for intermediate altitudes can be estimated by interpolation.

NOTE: Low-altitude line lengths tend to show a slight advantage for water-like retardants that is not necessarily supported by field data. The advantage of gum-thickened over water-like retardants increases rapidly under less-than-ideal conditions.

T07(15)

BLACK HILLS/ROSENBALM TANKED[1]
P2V-5 AIRCRAFT

Compartment #	1				2				3				4				5				6			
# of Compartments Dropped at One Time	1	2	3	6	1	2	3	6	1	2	3	6	1	2	3	6	1	2	3	6	1	2	3	6
Door Opening Time (sec.)	0.36	0.53	0.55	0.60	0.34	0.36	0.37	0.39	0.34	0.36	0.37	0.39	0.34	0.36	0.37	0.39	0.34	0.36	0.37	0.39	0.36	0.53	0.55	0.60
Vent Area (sq. ft.)	1.28	0.64	0.43	0.21	1.28	0.64	0.43	0.21	1.28	0.64	0.43	0.21	1.28	0.64	0.43	0.21	1.28	0.64	0.43	0.21	1.28	0.64	0.43	0.21
Door Area (sq. ft.)	12.25				8.75				8.75				8.75				8.75				12.25			
Door LxW (ft)	10.50x1.16				10.50x0.83				10.50x0.83				10.50x0.83				10.50x0.83				10.50x1.16			
Door Opening Angle (deg)	89				87				87				87				87				89			
Volume (gal)	442				392				392				392				392				442			

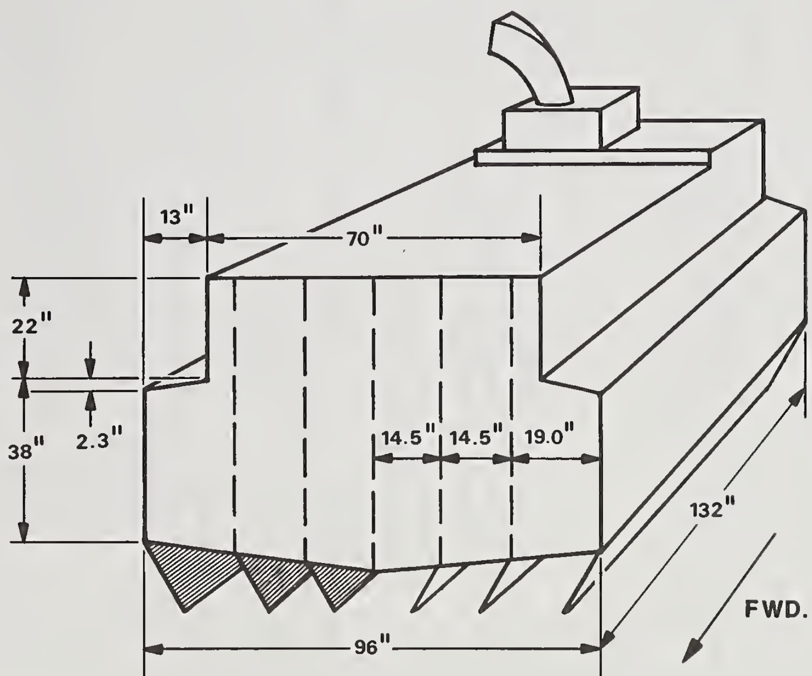
(1) Tanker 07, N96271, SN 131434, static tested June 1979 by NFFL

Other applicapable aircraft are: Tanker 06, N9855F, SN 131445

T07(16)

Typical Single-Compartment
Flow Rate (gal/sec)

Time (sec)	Number of Compartments Released at One Time							
	1 (O)	1 (I)	2 (O)	2 (I)	3 (O)	3 (I)	6 (O)	6 (I)
0.05	184	106	70	232	174	91	161	218
0.10	269	419	267	361	303	106	294	311
0.15	381	433	438	415	474	292	492	467
0.20	854	539	939	598	950	403	1123	492
0.25	1250	554	1208	626	1133	513	1246	573
0.30	1206	627	1201	626	1156	703	1173	652
0.35	1136	627	1205	618	1114	678	1153	633
0.40	1180	627	1166	597	1082	683	1154	614
0.45		597		590		700		614
0.50		597		602		684		614
0.55		597		610		633		619
0.60		698				664		663
Test No.	11-16	11-3	11-7	11-7	11-10	11-10	11-12	11-13
Compartment No.	6	5	6	5	6	5	6	5



T07(17)

APPENDIX D: BASIC PROGRAMS

PATSUM	Adds dissimilar tanks.
LLDELAY.TAB	Tabulates line length and delay data.
LDR WIDTH	Calculates line length down range and pattern width from PATSIM.
BESTSTRAT.DAT	Data portion of best strategy plot.
BS Plot	Plots best strategy graphs.
SMOOTHFOOT	Smooths footprint data prior to the use of FINALFOOT.
FINAL FOOT	Plots footprint graphs.

PATSUM

PATSUM is used to add nonequal patterns to simulate trail drops.

```
100 PRINT "patadd for 2 DISSIMILAR tanks"
105 SET DIA COL 3 | SET TEX COL 14 | SET TEX SIZ 4.0 | SET TEX STY 0
106 T$ = CHR$(27)
107 T$ = T$ & "MQ1" | T$ = "echo " & T$
108 CALL T$
109 INPUT PROMPT "what is the title? ":Tit$
110 INPUT PROMPT "what is the airspeed? ":Knots
120 DIM Valin1[56],Valin2[56],Itc[16]
130 DIM Tp[13440],Lcon[9],Conv[9],Aa[8],Sing1[1680],Lcmax[9],Xdel[9]
135 DIM Sing2[1680],Singx[1680]
140 DATA 0.5,1,2,3,4,6,8,10,12 | RESTORE 140
141 Itc = 0 | Itc[1] = 1 | Itc[2] = 1 | Itc[4] = 1 | Itc[8] = 1 | Itc[16] = 1
150 FOR I = 1 TO 9 | READ Conv[I] | NEXT I
160 PRINT "ENTER DATA FOR DROP 1 CENTER (ROW 14) ROW ENTER -1 TO STOP"
170 Valin1 = 0 | Valin2 = 0
180 FOR I = 1 TO 56 | PRINT "ENTER VALUE FOR ROW ";I
190   INPUT Q | IF Q<0 THEN EXIT TO 200 | Valin1[I] = Q | NEXT I
200 Npts1 = I-1
210 PRINT "ENTER DATA FOR DROP 2 CENTER (COL 14) COLUMN  ENTER -1 TO STOP"
220 FOR I = 1 TO 56 | PRINT "ENTER VALUE FOR ROW ";I
230   INPUT Q | IF Q<0 THEN EXIT TO 240 | Valin2[I] = Q | NEXT I
240 Npts2 = I-1
250 Jfirst = 0
260 Lalt = 0
261 Ialt = 1
270 Mcell = 5 ! LENGTH OF SUBCELL
280 Mstcl = 3 ! NUMBER OF SUBCELLS TO START
290 Mlncl = 6 ! NUMBER OF SUBCELLS TO A CELL
300 Fps = Knots*1.68781
310 Delt = 0.1 ! LENGTH (SEC) OF INTERVAL
320 Fpdel = Fps*Delt
330 Idcell = Fpdel/Mcell+0.5 ! COMPUTE NUMBER OF CELLS PER INTERVAL
340 REM EXPAND SINGLE PATTERN
350 Nto1 = Npts1+2 | Nto2 = Npts2+2
355 Qnext1 = 0 | Qnext2 = 0 | Xlastd1 = 0 | Xlastd2 = 0 | Xnextd1 = Mstcl | Xnextd2 = Mstcl
360 FOR I = 1 TO Nto1
370   Qlast1 = Qnext1
380   Qnext1 = Valin1[I]
390   Slope1 = (Qnext1-Qlast1)/(Xnextd1-Xlastd1)
400   Jx1 = Xlastd1+1
410   FOR J = Jx1 TO Xnextd1 | Sing1[J] = Qlast1+(J-Xlastd1)*Slope1 | NEXT J
420   Xlastd1 = Xnextd1
430   Xnextd1 = Xnextd1+Mlncl
```

```
 440 NEXT I
 450 Lspl = Npts1*Mlncl+Mlncl/2
 460 Nintvl = Lspl/Idcell+1
 470 REM SINGLE PATTERN 1 IS EXPANDED
 480 FOR I = 1 TO Nto2
 490   Qlast2 = Qnext2
 500   Qnext2 = Valin2[I]
 510   Slope2 = (Qnext2-Qlast2)/(Xnextd2-Xlastd2)
 520   Jx2 = Xlastd2+1
 530   FOR J = Jx2 TO Xnextd2 | Sing2[J] = Qlast2+(J-Xlastd2)*Slope2 | NEXT J
 540   Xlastd2 = Xnextd2
 550   Xnextd2 = Xnextd2+Mlncl
 560 NEXT I
 570 Lsp2 = Npts2*Mlncl+Mlncl/2
 580 Nintv2 = Lsp2/Idcell+1
 590 REM SINGLE PATTERN 2 IS EXPANDED
1000 REM ROUTINE TO ADD TOGETHER PATTERNS
1001 CLEAR
1002 Xpace = 1
1005 MOVE 0,95 | SET TEXT COLOR 1 | TEXT Tit$
1010 Ntankl = 0
1015 Xdel = 0 | Lcmax = 0
1020 FOR Jj = 1 TO 16
1030   Ntankl = Ntankl+1
1040   Xdel = 0 | Lcmax = 0
1050   IF Itc[Jj]<>1 THEN 2000
1051   K = 1
1052   GOSUB 5000
1060   FOR Jr = 1 TO Nintvx
1065     SET DIALOG COLOR 13 | PRINT Jr;" ";Nintvx | SET DIALOG COLOR 3
1070     J = Jr-1
1080     Idisp = J*Idcell
1090     Dly = J*Delt
1100     Maxl = Lspx+(Ntankl-1)*Idisp
1110     Tp = 0
1120     Idat = 0
1130     FOR K = 1 TO Ntankl
1135       GOSUB 5000
1140       FOR Kl = 1 TO Lspx
1150         Kk = Kl+Idat
1160         Tp[Kk] = Tp[Kk]+Singx[Kl]
1170       NEXT Kl
1180       Idat = Idat+Idisp
1190     NEXT K
1200     REM ROUTINE TO COMPUTE LENGTHS
1205     SET TEXT COLOR 13
1210     Lcon = 0
1220     FOR I = 1 TO Maxl
1230       FOR J = 1 TO 9
1240         IF Tp[I]>=Conv[J] THEN Lcon[J] = Lcon[J]+Mcell
1250       NEXT J
1260     NEXT I
1270     FOR K = 1 TO 9
1280       IF Lcmax[K]>=Lcon[K] THEN 1500
1290       Lcmax[K] = Lcon[K]
1300       Xdel[K] = Dly
```

```
1500      NEXT K
1506      IF Ntank1=1 THEN EXIT TO 1520
1510    NEXT Jr
1520    IF Lalt=Ialt THEN 1900
1530    IF Jfirst=0 THEN 1800
1540    REM PRINT
1800    Jfirst = 1
1810    MOVE 0,95-Xpace*10 | SET TEXT COLOR 13
1811    TEXT USING "D,A,2D,9(4D)":Ialt,"x",Ntank1,Lcmax
1812    MOVE 0,90-Xpace*10 | SET TEXT COLOR 3 | TEXT USING "4X,9(X,D.D)":Xdel
1820    Lalt = Ialt
1830    GOTO 1950
1900    MOVE 0,95-Xpace*10 | SET TEXT COLOR 13
1901    TEXT USING "2X,2D,9(4D)":Ntank1,Lcmax
1902    MOVE 0,90-Xpace*10 | SET TEXT COLOR 3 | TEXT USING "4X,9(X,D.D)":Xdel
1950    Xpace = Xpace+1
2000 NEXT Jj
2010 REM END OOF LTHIS ALTITUDE AND VELOCITY
4999 END
5000 SELECT CASE K
5010 CASE 1;4;5;8;9;12;13;16
5020    GOTO 6000
5030 CASE ELSE
5040    GOTO 7000
5050 END SELECT
6000 Nintvx = Nintv1
6010 Lspx = Lsp1
6020 Singx = Sing1
6030 SET DIALOG COLOR 14 | PRINT "#1 JJ=";Jj | SET DIALOG COLOR 3
6040 RETURN
7000 Nintvx = Nintv2
7010 Lspx = Lsp2
7020 Singx = Sing2
7030 SET DIALOG COLOR 4 | PRINT "#2 jj=";Jj | SET DIALOG COLOR 3
7040 RETURN
```

LLDELAY.TAB

This program stores prints and stores the data for the detailed line length/opening delay tables, located near the end of the guideline.

```
  1 GOTO 3000
  4 GOTO 100
  8 GOTO 700
 12 GOTO 4000
 16 GOTO 800
 20 GOTO 1000
 24 GOTO 5000
 28 GOTO 6000
100 CLEAR
110 DIM D1[50,8],D2[50,8],Z1[50],Z2[50]
120 D1 = 0
130 D3 = 0
140 D2 = 0
150 D4 = 0
160 DATA 0.5,1,2,3,4,6,8,10
170 DIM Z[8]
```

```
180 RESTORE 160
190 FOR I = 1 TO 8
200   READ Z[I]
210 NEXT I
220 DATA 1.1,1.2,1.3,1.6,1.1
230 DATA 1.2,1.3,1.6,1.1,1.2
240 DATA 1.3,1.6,1.1,1.2,1.3
250 DATA 1.6,1.1,1.2,1.3,1.6
260 DATA 2.1,2.2,2.3,2.1,2.2,2.3,2.1,2.2,2.3,2.1
270 DATA 2.2,2.3,2.1,2.2,2.3,3.1,3.2,3.1,3.2,3.1
280 DATA 3.2,3.1,3.2,3.1,3.2,6.1,6.1,6.1,6.1,6.1
310 RESTORE 220
320 FOR I = 1 TO 50
330   READ Z1[I]
340 NEXT I
350 DATA 1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4,5,5,5,5,1,1,1
360 DATA 2,2,2,3,3,3,4,4,4,5,5,5,1,1,2,2,3,3,4,4
370 DATA 5,5,1,2,3,4,5
380 RESTORE 350
390 FOR I = 1 TO 50
400   READ V3
410   Z2[I] = V3*100
420 NEXT I
440 FOR I = 1 TO 8
450   FOR J = 1 TO 50
460     PRINT Z1[J];"  ";Z[I];" gpc ";Z2[J];" feet ";
470     INPUT D1[J,I]
480   NEXT J
490 NEXT I
500 PRINT "DELAYS"
510 FOR I = 1 TO 8
520   FOR J = 1 TO 50
530     PRINT Z1[J];"  ";Z[I];" gpc ";Z2[J];" FEET ";
540     INPUT D2[J,I]
550   NEXT J
560 NEXT I
570 PRINT "DATA ENTERED"
580 PRINT "DO YOU WANT TO STORE THE DATA ON A FILE? ";
590 INPUT Z$
600 O$ = SEG$(Z$,1,1)
610 IF O$="Y" THEN 700
620 END
700 PRINT "ENTER TITLE-";
710 INPUT Q$
720 PRINT "WHAT FILE? ";
730 INPUT F$
740 OPEN #1:F$,"F"
750 PRINT #1:F$,Q$,D1,D2
760 PRINT "DATA FOR: ";Q$;" ON HARD DISC ON FILE ";F$
770 CLOSE
780 END
800 PRINT "WHAT FILE? ";
810 INPUT F$
811 DELETE D1,D2,Z1,D3,D4,Z2
812 DIM D1[50,8],D2[50,8]
820 OPEN #1:F$,"R"
830 INPUT #1:F$,Q$,D1,D2
```

```
 840 PRINT "DATA ENTERED FROM FILE ";F$;" ";Q$
 850 END
1000 OPEN #41:"printfile","f"
1010 PRINT #41:Q$
1020 Z4 = 0
1030 C = 1
1040 S$ = "                           |------------|------------|------"
1050 T$ = "------|------------|------------|------------|------------|------------|"
1060 DATA 1,2,3,6,1,2,3,6,1,2,3,6,1,2,3,6,1,2,3,6
1065 DATA 1,2,3,1,2,3,1,2,3,1,2,3,1,2,3
1070 DATA 1,2,1,2,1,2,1,2,1,2,1,1,1,1,1
1090 P$ = "------------|"
1100 RESTORE 1060
1110 DELETE Z3
1120 DIM Z3[50]
1130 FOR I = 1 TO 50
1140   READ Z3[I]
1150 NEXT I
1160 PRINT #41:"                           ";
1170 FOR I = 26 TO 129
1180   PRINT #41:"_";
1190 NEXT I
1200 PRINT #41:"_"
1210 PRINT #41:"                           |";
1220 PRINT #41:"         LEVEL 1         |";
1230 PRINT #41:"   LEVEL 2   |   LEVEL 3   |                LEVEL 4";
1240 PRINT #41:"                            |"
1250 PRINT #41:S$;T$;P$
1260 PRINT #41:"                           |";
1270 PRINT #41:"                                    COVERAGE(GALLONS/";
1280 PRINT #41:"100 SQ.FT.)                                  |"
1290 PRINT #41:S$;T$;P$
1300 PRINT #41:"                           |";
1310 PRINT #41 USING 2790:0.5,"|",1,"|",2,"|",3,"|",4,"|",6,"|",8,"|"
1320 PRINT #41:"   10.0     |"
1330 S$ = "|------------|----|--------|------------|------------|------"
1340 PRINT #41:S$;T$;P$
1350 PRINT #41:"|COMPARTMENTS|DROP|NO.OF   |  MAX |DELAY|  MAX |DELAY|";
1360 PRINT #41:"  MAX |DELAY|  MAX |DELAY|  MAX |DELAY|  MAX |DELAY|";
1370 PRINT #41:"  MAX |DELAY|  MAX |DELAY|"
1380 PRINT #41:"|  RELEASED  | HT |PATTERNS|LENGTH|(SEC)|LENGTH|(SEC)|";
1390 PRINT #41:"LENGTH|(SEC)|LENGTH|(SEC)|LENGTH|(SEC)|LENGTH|(SEC)|";
1400 PRINT #41:"LENGTH|(SEC)|LENGTH|(SEC)|"
1410 PRINT #41:"|  AT A TIME | FT |        | (FT) |     | (FT) |     |";
1420 PRINT #41:" (FT) |     | (FT) |     | (FT) |     | (FT) |     |";
1430 PRINT #41:" (FT) |     | (FT) |     |"
1440 S$ = "|------------|----|--------|------|-----|------|-----|------|"
1450 T$ = "-----|------|-----|------|-----|------|-----|------|-----|"
1460 P$ = "------|-----|"
1470 DELETE V$,U$
1480 DIM V$(132),U$(132)
1490 U$ = S$ & T$
1500 U$ = U$ & P$
1510 PRINT #41:U$
1520 S$ = "|            |----|--------|------|-----|------|-----|------|"
1530 V$ = S$ & T$
```

```
1540 V$ = V$ & P$
1550 FOR I = 1 TO 50
1560   IF I=3 OR I=27 OR I=47 OR I=61 OR I=71 THEN 2380
1570   IF I=8 OR I=31 OR I=49 OR I=63 OR I=72 THEN 2400
1580   IF I=13 THEN 2440
1590   IF I=35 THEN 2460
1600   IF I=53 THEN 2480
1610   IF I=65 THEN 2500
1615   IF I=73 THEN 2520
1620   IF I=18 OR I=39 OR I=56 OR I=67 OR I=74 THEN 2640
1630   IF I=23 OR I=43 OR I=59 OR I=69 OR I=75 THEN 2760
2070   IF Z3[I]<>12 THEN 2075
2071   PRINT #41:"|            |    |   ";Z3[I];"   ";
2072   GOTO 2080
2075   PRINT #41:"|            |    |    ";Z3[I];"   ";
2080   FOR J = 1 TO 8
2081     IF Q$<>"BLANK" THEN 2090
2082     IF D1[I,J]=0 THEN 2095
2090     PRINT #41 USING "A,6D,A,3D.D,S":"|",D1[I,J],"|",D2[I,J]
2093     GOTO 2100
2095     PRINT #41 USING "A,6X,A,5X,S":"|","|"
2100   NEXT J
2110   PRINT #41:"|"
2115   REM NEXT IS LONG LINE
2120   IF I=25 OR I=45 OR I=60 OR I=70 OR I=75 THEN 2830
2125   REM NEXT TWO ARE SHORT LINES
2130   IF I=5 OR I=10 OR I=15 OR I=20 OR I=29 OR I=33 OR I=37 THEN 2810
2140   IF I=41 OR I=48 OR I=51 OR I=54 OR I=57 OR I=62 THEN 2810
2141   IF I=64 OR I=66 OR I=68 THEN 2810
2340 NEXT I
2350 Z4 = 1
2360 CALL "lpr printfile"
2361 END
2370 NEXT I
2380 PRINT #41:"|            | 100|    ";Z3[I];"   ";
2390 GOTO 2080
2400 PRINT #41:"|            | 200|    ";Z3[I];"   ";
2410 GOTO 2080
2420 ON C GOTO 2440,2460,2480,2500,2520,2540,2560,2580,2580,2580
2440 PRINT #41:"|     ONE    | 300|    ";Z3[I];"   ";
2450 GOTO 2590
2460 PRINT #41:"|     TWO    | 300|    ";Z3[I];"   ";
2470 GOTO 2590
2480 PRINT #41:"|    FOUR    | 300|    ";Z3[I];"   ";
2490 GOTO 2590
2500 PRINT #41:"|     SIX    | 300|    ";Z3[I];"   ";
2510 GOTO 2590
2520 PRINT #41:"|   TWELVE   | 300|    ";Z3[I];"   ";
2530 GOTO 2590
2580 GOTO 2860
2590 C = C+1
2600 GOTO 2080
2610 ON C-1 GOTO 2640,2660,2680,2700,2620,2720,2740,2620,2620,2620
2620 PRINT #41:"| (ALL COMB) | 400|    ";Z3[I];"   ";
2630 GOTO 2080
2640 PRINT #41:"|            | 400|    ";Z3[I];"   ";
2650 GOTO 2080
```

```
2660 PRINT #41:"|     (I)    | 400|    ";Z3[I];"   ";
2670 GOTO 2080
2680 PRINT #41:"|    (O,I)   | 400|    ";Z3[I];"   ";
2690 GOTO 2080
2700 PRINT #41:"|    (I,I)   | 400|    ";Z3[I];"   ";
2710 GOTO 2080
2720 PRINT #41:"|    (O+I)   | 400|    ";Z3[I];"   ";
2730 GOTO 2080
2740 PRINT #41:"|    (I+I)   | 400|    ";Z3[I];"   ";
2750 GOTO 2080
2760 PRINT #41:"|            | 500|    ";Z3[I];"   ";
2770 GOTO 2080
2780 CALL "lpr printfile"
2781 END
2790 IMAGE 7(4X,2D.D,4X,A),S
2800 IMAGE A,5D,A,D.D,S
2810 PRINT #41:V$
2820 GOTO 2340
2830 PRINT #41:U$
2840 IF Z4=1 THEN 2360
2850 GOTO 2340
2860 ON C-7 GOTO 2880,2900,2920
2870 GOTO 2590
2880 PRINT #41:"|     TWO    | 300|    ";Z3[I];"   ";
2890 GOTO 2590
2900 PRINT #41:"|   THREE    | 300|    ";Z3[I];"   ";
2910 GOTO 2590
2920 PRINT #41:"|   SIX      | 300|    ";Z3[I];"   ";
2930 GOTO 2590
3000 CLEAR
3010 PRINT "USER DEFINABLE KEYS:"
3020 PRINT "1.  ENTER DATA"
3030 PRINT "2.  STORE DATA"
3040 PRINT "3.  MAKE CORRECTION"
3050 PRINT "4.  RETRIVE DATA"
3060 PRINT "5.  PRINT LINE LENGTH-DELAY TABLE"
3065 PRINT "6.  SUBTRACT WATER FROM RETARDANT & PRINT TABLE"
3066 PRINT "7.  PRINT TABLE W/O LINES (FOR PRINTERS)"
3080 END
3090 FOR I = 1 TO 30
3100   FOR J = 1 TO 8
3110     D1[I,J] = 100*I+J
3120     D2[I,J] = 1+J/10
3130   NEXT J
3140 NEXT I
3150 GOTO 570
3160 END
4000 CLEAR
4010 PRINT "ENTER THE ROW NUMBER THEN THE GPC ";
4020 INPUT C1,C2
4021 IF C1=0 AND C2=0 THEN 580
4030 IF C2=6 THEN 4070
4040 IF C2<>8 THEN 4050
4042 C2 = 7
4044 GOTO 4070
4050 IF C2<>10 THEN 4060
4052 C2 = 8
```

```
4054 GOTO 4070
4060 C2 = INT(C2+1)
4070 PRINT "THE PRESENT VALUES ARE : ";D1[C1,C2];" ";D2[C1,C2]
4080 PRINT "ENTER NEW VALUES ";
4090 INPUT D1[C1,C2],D2[C1,C2]
4095 GOTO 4010
5000 CLEAR
5005 DELETE W1,R1,D1,D2
5010 DIM W1[50,8],R1[50,8],D2[50,8],D1[50,8]
5020 PRINT "WHAT FILE FOR WATER? ";
5030 INPUT F$
5040 OPEN #1:F$,"R"
5050 READ #1:F$,W$,W1
5060 PRINT "WHAT FILE FOR RETARDANT? ";
5070 INPUT G$
5080 OPEN #2:G$,"R"
5090 READ #2:G$,R$,R1
5100 D1 = R1-W1
5110 D2 = 0
5120 Q$ = "RETARDANT-WATER"
5125 CLOSE
5130 GOTO 1000
6000 REM
6010 OPEN #41:"PRINTFILE","W"
6020 PRINT #41:
6030 Z4 = 0
6040 C = 1
6050 S$ = ""
6060 T$ = ""
6070 DATA 1,2,3,6,1,2,3,6,1,2,3,6,1,2,3,6,1,2,3,6,1,2,3,1,2,3,1,2,3
6080 DATA 1,2,3,1,2,3,1,2,1,2,1,2,1,2,1,2,1,1,1,1,1
6100 P$ = ""
6110 RESTORE 6070
6120 DELETE Z3
6130 DIM Z3[50]
6140 FOR I = 1 TO 50
6150   READ Z3[I]
6160 NEXT I
6170 PRINT #41:
6210 PRINT #41:
6220 PRINT #41:"                              ";
6230 PRINT #41:"        LEVEL 1          ";
6240 PRINT #41:"   LEVEL 2      LEVEL 3`                  LEVEL 4";
6250 PRINT #41:"                              "
6260 PRINT #41:
6270 PRINT #41:"                              ";
6280 PRINT #41:"                                   COVERAGE(GALLONS/";
6290 PRINT #41:"100 SQ.FT.)                                 "
6300 PRINT #41:
6310 PRINT #41:"                              ";
6320 PRINT #41 USING 7800:0.5," ",1," ",2," ",3," ",4," ",6," ",8," "
6330 PRINT #41:"   10.0      "
6350 PRINT #41:
6360 PRINT #41:" COMPARTMENTS DROP NO.OF      MAX  DELAY   MAX  DELAY ";
```

```
6370 PRINT #41:"  MAX  DELAY   MAX  DELAY   MAX  DELAY   MAX  DELAY ";
6380 PRINT #41:"  MAX  DELAY   MAX  DELAY "
6390 PRINT #41:"   RELEASED    HT  PATTERNS LENGTH (SEC) LENGTH (SEC) ";
6400 PRINT #41:"LENGTH (SEC) LENGTH (SEC) LENGTH (SEC) LENGTH (SEC) ";
6410 PRINT #41:"LENGTH (SEC) LENGTH (SEC) "
6420 PRINT #41:"   AT A TIME   FT            (FT)         (FT)        ";
6430 PRINT #41:" (FT)         (FT)         (FT)         (FT)        ";
6440 PRINT #41:" (FT)         (FT)        "
6500 U$ = ""
6520 PRINT #41:
6540 V$ = ""
6560 FOR I = 1 TO 50
6562   IF I=3 OR I=36 OR I=46 OR I=22 THEN 6800
6570   IF I=6 OR I=25 OR I=38 OR I=47 THEN 6820
6580   IF I=10 THEN 6850
6590   IF I=28 THEN 6870
6600   IF I=40 THEN 6890
6610   IF I=48 THEN 6910
6620   IF I=14 OR I=31 OR I=42 OR I=49 THEN 6990
6630   IF I=18 OR I=34 OR I=44 OR I=50 THEN 7110
6640   PRINT #41:"                           ";Z3[I];"   ";
6650   FOR J = 1 TO 8
6660     IF Q$<>"BLANK" THEN 6680
6670     IF D1[I,J]=0 THEN 6700
6680     PRINT #41 USING "A,6D,A,3D.D,S":" ",D1[I,J]," ",D2[I,J]
6690     GOTO 6710
6700     PRINT #41 USING "A,6X,A,5X,S":" "," "
6710   NEXT J
6720   PRINT #41:" "
6730   IF I=20 OR I=35 OR I=45 OR I=50 THEN 7180
6740   IF I=4 OR I=8 OR I=12 OR I=16 OR I=23 OR I=26 OR I=29 THEN 7160
6750   IF I=32 OR I=37 OR I=39 OR I=41 OR I=43 THEN 7160
6760 NEXT I
6770 Z4 = 1
6780 END
6790 NEXT I
6800 PRINT #41:"               100     ";Z3[I];"   ";
6810 GOTO 6650
6820 PRINT #41:"               200     ";Z3[I];"   ";
6830 GOTO 6650
6840 ON C GOTO 6850,6870,6890,6910,2520,2540,2560,6930,6930,6930
6850 PRINT #41:"      ONE      300     ";Z3[I];"   ";
6860 GOTO 6940
6870 PRINT #41:"      TWO      300     ";Z3[I];"   ";
6880 GOTO 6940
6890 PRINT #41:"     THREE     300     ";Z3[I];"   ";
6900 GOTO 6940
6910 PRINT #41:"      SIX      300     ";Z3[I];"   ";
6920 GOTO 6940
6930 GOTO 7210
6940 C = C+1
6950 GOTO 6650
6960 ON C-1 GOTO 6990,7010,7030,7050,6970,7070,7090,6970,6970,6970
6990 PRINT #41:"               400     ";Z3[I];"   ";
7000 GOTO 6650
7110 PRINT #41:"               500     ";Z3[I];"   ";
7120 GOTO 6650
```

```
7130 CALL "lpr PRINTFILE"
7131 END
7140 IMAGE 7(4X,2D.D,4X,A),S
7150 IMAGE A,5D,A,D.D,S
7160 PRINT #41:V$
7170 GOTO 6760
7180 PRINT #41:U$
7190 IF Z4=1 THEN 6780
7200 GOTO 6760
7210 ON C-7 GOTO 7230,7250,7270
7220 GOTO 6940
7230 PRINT #41:"|     TWO     | 300|     ";Z3[I];"    ";
7240 GOTO 6940
7250 PRINT #41:"|    THREE    | 300|     ";Z3[I];"    ";
7260 GOTO 6940
7270 PRINT #41:"|    SIX      | 300|     ";Z3[I];"    ";
7280 GOTO 6940
7800 IMAGE 7(4X,2D.D,4X,A),S
```

LDRWIDTH

This program requires input of data from the detailed pattern section of the PATSIM output and calculates the line length, downrange position and width for 1, 2, 3, 4, and 5 gpc to be used in the FOOTPRINTS. Because the detailed pattern section of the PATSIM output is bilaterally symetrical about rows 14-15, only data from the left side are entered. The program uses a linear interpolation for its calculations and starts at 1 gpc. Data more than one space to the left or above and below 1-gpc values are not used and need not be entered.

```
  8 GOTO 50000
 20 GOTO 50000
100 REM CALCULATE THE AVERAGE WIDTH, DOWNRANGE AND LENGHT FROM PATSIM
105 K7 = 0
110 PRINT "ENTER THE ID FOR THIS DROP--";
120 INPUT I$
130 DIM D[40,14],Ans[40,5],Start[2],Finish[2]
140 Ans = 0
150 D = 0
160 Start = 0
170 Finish = 0
180 PRINT "DO YOU WISH TO RECALL A FILE? IF YES ENTER NAME ELSE CR ";
190 INPUT F$
200 IF F$="" THEN 250
205 DIM X$(300)
210 OPEN #1:F$,"R",X$
220 READ #1:I$,D
230 GOTO 490
240 PRINT "ENTER -1 TO TERMINATE A COLUMN"
250 FOR I = 1 TO 7
260   FOR J = 1 TO 40
270     PRINT "WHAT IS THE VALUE No.";J;" FOR COL. ";I+7;" ? ";
280     INPUT Test
290     IF Test<0 THEN EXIT TO 320
300     D[J,I] = Test
310   NEXT J
320 NEXT I
330 FOR I = 1 TO 40
340   D[I,8] = D[I,7]
350   D[I,9] = D[I,6]
```

```
360   D[I,10] = D[I,5]
370   D[I,11] = D[I,4]
380   D[I,12] = D[I,3]
390   D[I,13] = D[I,2]
400   D[I,14] = D[I,1]
410 NEXT I
420 PRINT "WHAT FILE FOR STORAGE? ";
430 INPUT S$
450 OPEN #1:S$,"F",X$
460 WRITE #1:I$,D
470 CLOSE
480 PRINT "DATA SAVED ON DISC FILE ";S$
490 Count = 1
500 Start = 0
520 FOR Gpc = 1 TO 5
530   FOR Row = 1 TO 14
540     IF Start[1]>0 THEN 590
550     IF D[Count,Row]<Gpc THEN 630
560     IF Start[1]<>0 THEN 630
570     Start[1] = Row
580     Start[2] = D[Count,Row]
590     IF D[Count,Row]>=Gpc THEN 630
600     Finish[1] = Row-1
610     Finish[2] = D[Count,Finish[1]]
620     EXIT TO 640
630   NEXT Row
640   IF Start[1]=0 THEN 790
650   W = (Finish[1]-Start[1])*15
660   IF Start[1]=1 THEN 710
670   Wtop = (Start[2]-Gpc)/(Start[2]-D[Count,Start[1]-1])*15
680   Wbot = (Finish[2]-Gpc)/(Finish[2]-D[Count,Finish[1]+1])*15
690   W = W+Wtop+Wbot
700   GOTO 740
710   Wtop = (Start[2]-Gpc)/Start[2]*15
720   Wbot = (Finish[2]-Gpc)/Finish[2]*15
730   W = W+Wtop+Wbot
740   Ans[Count,Gpc] = W
750   REM print "*";gpc;" ";w;" ";Start(1);" ";finish(1);"*";wtop;" ";wbot
760   Start = 0
770   Row = 0
780 NEXT Gpc
790 Count = Count+1
800 IF Count=41 THEN 820
810 GOTO 520
820 DIM Som[5]
830 Som = 0
840 FOR Gpc = 1 TO 5
850   FOR I = 1 TO 40
860     Som[Gpc] = Som[Gpc]+Ans[I,Gpc]
870   NEXT I
880 NEXT Gpc
890 CLEAR
1000 DIM Ave[5]
1010 De = 41
1020 Ave = 0
1030 Count1 = 0
1040 Count2 = 0
```

```
1050 Count3 = 0
1060 Count4 = 0
1070 Count5 = 0
1080 P$ = "5(1X,4D.D,2X)"
1090 FOR I = 1 TO 40
1100   IF Ans[I,1]=0 THEN 1200
1110   Count1 = Count1+1
1120   IF Ans[I,2]=0 THEN 1200
1130   Count2 = Count2+1
1140   IF Ans[I,3]=0 THEN 1200
1150   Count3 = Count3+1
1160   IF Ans[I,4]=0 THEN 1200
1170   Count4 = Count4+1
1180   IF Ans[I,5]=0 THEN 1200
1190   Count5 = Count5+1
1200 NEXT I
1210 Ave[1] = Som[1]/Count1
1220 IF Som[2]=0 THEN 1380
1230 Ave[2] = Som[2]/Count2
1240 IF Som[3]=0 THEN 1380
1250 Ave[3] = Som[3]/Count3
1260 IF Som[4]=0 THEN 1380
1270 Ave[4] = Som[4]/Count4
1280 IF Som[5]=0 THEN 1380
1290 Ave[5] = Som[5]/Count5
1380 GOTO 10000
10000 DIM D14[40],L[5,8],L9[5],M2[8]
10010 D14 = 0
10020 FOR I = 1 TO 40
10030   D14[I] = D[I,7]
10040 NEXT I
10050 L = 0
10060 L9 = 0
10070 M2 = 0
10080 FOR J = 1 TO 5
10090   C = 1
10100   K = 1
10110   IF D14[K]>=J THEN 10150
10120   K = K+1
10130   IF K=41 THEN 10370
10140   GOTO 10110
10150   A = K*30
10160   O = D14[K]
10170   IF K<>1 THEN 10200
10180   U = 0
10190   GOTO 10210
10200   U = D14[K-1]
10210   A = A-30/(O-U)*(O-J)
10220   L[J,C] = A
10230   C = C+1
10240   K = K+1
10250   IF K=41 THEN 10310
10260   IF D14[K]<J THEN 10300
10270   K = K+1
10280   IF K=41 THEN 10370
10290   GOTO 10260
```

```
10300   B = (K-1)*30
10310   O = D14[K-1]
10320   U = D14[K]
10330   B = B+30/(O-U)*(O-J)
10340   L[J,C] = B
10350   C = C+1
10360   GOTO 10120
10370   L9[J] = L9[J]+(L[J,2]-L[J,1])+(L[J,4]-L[J,3])+(L[J,6]-L[J,5])
10380   L9[J] = L9[J]+L[J,8]-L[J,7]
10390 NEXT J
20000 REM PRINT SECTION
20001 Far = LEN(X$)
20002 X$ = SEG$(X$,200,Far-200)
20003 X$ = EDIT$(X$,"b")
20020 P$ = "2X,2(4D,X),S"
20022 DELETE FILE "printfile"
20025 OPEN #2:"printfile","f"
20030 PRINT #2:I$;"  ";X$
20031 PRINT #2:
20032 PRINT #2:
20040 PRINT #2:"*******************************************************";
20050 PRINT #2:"***********"
20060 PRINT #2:"   ";"     ";
20070 PRINT #2:"    1           2           3           4           5"
20080 PRINT #2:"********DR***D+L****DR***D+L****DR***D+L****DR***D+L***";
20090 PRINT #2:"*DR***D+L**"
20100 R$ = "4X,4D,4X,S"
20110 FOR J = 1 TO 5
20120   ON J GOTO 20130,20270,20400,20530,20660
20130   PRINT #2:"L1   ";
20140   FOR I1 = 1 TO 5
20150     PRINT #2 USING P$:L[I1,1],L[I1,2]
20160   NEXT I1
20170   PRINT #2:
20180   PRINT #2:"LEN  ";
20190   FOR Count = 1 TO 5
20200     PRINT #2 USING R$:L[Count,2]-L[Count,1]
20210   NEXT Count
20220   PRINT #2:
20230   PRINT #2:"---------------------------------------------------------";
20240   PRINT #2:"----------"
20250 NEXT J
20260 GOTO 20660
20270 PRINT #2:"L2   ";
20280 FOR I1 = 1 TO 5
20290   PRINT #2 USING P$:L[I1,3],L[I1,4]
20300 NEXT I1
20310 PRINT #2:
20320 PRINT #2:"LEN  ";
20330 FOR Count = 1 TO 5
20340   PRINT #2 USING R$:L[Count,4]-L[Count,3]
20350 NEXT Count
20360 PRINT #2:
20370 PRINT #2:"---------------------------------------------------------";
20380 PRINT #2:"----------"
20390 GOTO 20250
20400 PRINT #2:"L3   ";
```

```
20410 FOR I1 = 1 TO 5
20420   PRINT #2 USING P$:L[I1,5],L[I1,6]
20430 NEXT I1
20440 PRINT #2:
20450 PRINT #2:"LEN  ";
20460 FOR Count = 1 TO 5
20470   PRINT #2 USING R$:L[Count,6]-L[Count,5]
20480 NEXT Count
20490 PRINT #2:
20500 PRINT #2:"--------------------------------------------------------";
20510 PRINT #2:"----------"
20520 GOTO 20250
20530 PRINT #2:"L4   ";
20540 FOR I1 = 1 TO 5
20550   PRINT #2 USING P$:L[I1,7],L[I1,8]
20560 NEXT I1
20570 PRINT #2:
20580 PRINT #2:"LEN  ";
20590 FOR Count = 1 TO 5
20600   PRINT #2 USING R$:L[Count,8]-L[Count,7]
20610 NEXT Count
20620 PRINT #2:
20630 PRINT #2:"--------------------------------------------------------";
20640 PRINT #2:"----------"
20650 GOTO 20250
20660 Q$ = "4X,3D.D,3X,S"
20670 PRINT #2:"WIDTH ";
20680 FOR I = 1 TO 5
20690   PRINT #2 USING Q$:Ave[I]
20700 NEXT I
20710 PRINT #2:
30000 PRINT #2:"ROW     8     9    10    11    12    13    14"
30010 FOR I = 1 TO 22
30020   PRINT #2 USING "2D,3X,S":I
30030   FOR J = 1 TO 7
30040     PRINT #2 USING "X,2D.D,X,S":D[I,J]
30050   NEXT J
30060   PRINT #2:
30070 NEXT I
30080 CLOSE #2
30085 CALL "lpr printfile"
30090 GOTO 100
50000 REM correct data
50005 K7 = 1
50010 PRINT "WHAT FILE? ";
50020 INPUT F$
50030 DIM D[40,14],Ans[40,5],Start[2],Finish[2]
50031 Ans = 0
50032 Start = 0
50033 D = 0
50034 Finish = 0
50040 OPEN #1:F$,"R",X$
50050 READ #1:I$,D
50055 CLOSE
50060 CLEAR
50070 PRINT "DATE FOR: ";I$;" IN MEMORY"
50071 PRINT "ENTER P FOR PRINT ELSE CR";
```

```
50072 INPUT Q$
50073 IF Q$="P" THEN 490
50080 PRINT "TO EXIT CORRECTION FOR THIS FILE ENTER -1 FOR COLUMN AND ROW"
50090 PRINT "ENTER COLUMN THEN ROW ";
50100 INPUT Column,Row
50105 Column = Column-7
50110 IF Column<0 THEN 50150
50120 PRINT "PRESENT VALUE: ";D[Row,Column];" NEW VALUE? ";
50130 INPUT D[Row,Column]
50140 GOTO 50090
50150 REM STORAGE AND FILLOUT SECTION
50160 FOR I = 1 TO 40
50170   D[I,8] = D[I,7]
50180   D[I,9] = D[I,6]
50190   D[I,10] = D[I,5]
50200   D[I,11] = D[I,4]
50210   D[I,12] = D[I,3]
50220   D[I,13] = D[I,2]
50230   D[I,14] = D[I,1]
50240 NEXT I
50250 PRINT "PRESS RETURN TO RESTORE DATA ON THE SAME FILE ";
50260 INPUT Q$
50270 OPEN #1:F$,"F",X$ ! ??
50280 WRITE #1:I$,D
50290 CLOSE
50300 PRINT "DO YOU WANT TO PRINT THE NEW DATA? (Y OR N ) ";
50310 INPUT Q$
50320 IF Q$="N" THEN 50340
50330 GOTO 490
50340 END
```

BESTSTRAT.DAT/BS Plot

The line length versus height data for each drop type is smoothed by using a standard simple regression that determines the best fit of the data to one of eight curve forms, $Y = AX$; $Y = A+BX$; $Y = Ae^{BX}$; $Y = 1/(A+BX)$; $Y = A+B/X$; $Y = A+BlogX$; $Y = AX^B$; and $Y = X/(A+BX)$. Y = drop height and X = line length. These equations along with the type of drop are entered into BESTSTRAT.DAT lines 1000 to 2000 and the data are plotted. After selection of the type of drop for each volume, the remaining equations are set to 0 (lines 1000-2000) and a final plot made.

```
1 GO TO 100  !PRINT MENU
2 REM WATER LIKE 3 GPC CONAIR DC-6B TANKER 454
4 GO TO 2010  !CALCULATE STRATIGIES AND PLOT
8 GO TO 3270  !REPLOT WITH PREVIOUSLY ENTERED PARAMETERS
12 GO TO 8000  !PRINT A LABEL ON THE 4662 PLOTTER
16 T9=0  !PLOT CALCULATED DATA
17 GO TO 2010
20 GO TO 9000  !PRINT ON PLOTTER XTxXR LABEL
24 GO TO 11000  !DRAW LEFT ARROWHEAD
28 GO TO 10000  !DRAW RIGHT ARROWHEAD
44 APPEND "BSPLOT.A" AT 2000  !APPEND PLOT PROGRAM
45 V6=0
46 GO TO 4
100 CLEAR
102 V6=0
110 PRINT "1. CALCULATE DATA"
120 PRINT "2. DRAW AXES WITH PREVIOUSLY ENTERED PARAMETERS"
130 PRINT "3. ENTER AND PRINT A LABEL"
140 PRINT "4. INPUT PARAMETERS FOR AND DRAW GRAPH FROM CALCULATED DATA"
```

```
150 PRINT "5. PRINT XTxXR LABEL"
160 PRINT "6. DRAW LEFT POINT ARROWHEAD"
170 PRINT "7. DRAW RIGHT POINT ARROWHEAD"
180 PRINT "11. APPEND PLOT PORTION FRON 4907 DISC"
280 END
990 !PROGRAM EQUATIONS AND ID STRINGS FOR STRATIGIES X=0 FOR NO ENTRY
1000 A$="1X1 "
1010 X=0
1020 RETURN
1030 B$="1X2     "
1040 X=0
1050 RETURN
1060 C$="1X4"
1070 X=3614.14759953*J^-0.599571655413
1080 RETURN
1090 D$="1X12"  !EQUATION AT 1110 IS BASIS FOR NO CAPABILITY AREA
1095 IF J>376 THEN 1251
1100 X=1496.07186437*EXP(-0.00347487486045*J)
1110 RETURN
1120 E$="1X6"
1130 X=1295.28917901-189.349621044*LOG(J)
1140 RETURN
1150 F$="2X1"
1160 X=0
1170 RETURN
1180 G$="2X2"
1190 REM X=779.924741195-119.17387092*LOG(J)
1191 X=0
1200 RETURN
1210 H$="2X3"
1220 REM X=12637.4777927*J^-0.741958999899
1221 X=0
1230 RETURN
1240 I$="2X6"
1250 RETURN
1251 X=1/(5.69473125E-4+5.052039738E-6*J)
1260 RETURN
1270 J$="4X1"
1280 REM X=236.666666667-0.675*J
1281 X=0
1290 RETURN
1300 K$="4X2"
1310 REM X=587.447659418*EXP(-0.00286385476043*J)
1311 X=0
1320 RETURN
1330 L$="4X3"
1340 REM X=873.435667466*EXP(-0.00244759118039*J)
1341 X=0
1350 RETURN
1360 M$="6X1"
1370 REM X=864.121558318-135.493350465*LOG(J)
1371 X=0
1380 RETURN
1390 N$="6X2"
1400 REM X=751.760972274*EXP(-0.0024352907181*J)
1401 X=0
1410 RETURN
```

```
1420 O$="12X1"
1430 REM X=1762.81484802-292.712597148*LOG(J)
1431 X=0
1440 RETURN
2000 REM TARGET LINE FOR APPENDING PLOT PORTION
2000 REM PLOT PORTION OF BEST STRATEGY CHART
2010 DELETE A,B,C,D,E1,E2,E3,E4,E5,E6,E7,E8,E9,F1,F2
2020 DIM A(26),B(26),C(26),D(26),E1(26),E2(26),E3(26)
2030 DIM E4(26),E5(26),E6(26),E7(26),E8(26),E9(26)
2040 DIM F1(26),F2(26),Height(26)
2050 FOR I=1 TO 15
2060    C1=1
2070    FOR J=150 TO 500 STEP 14
2080       GOSUB I OF 1000,1030,1060,1090,1120,1150,1180,1210,1240,1270
2090       IF I<11 THEN 2110
2100       GOSUB I-10 OF 1300,1330,1360,1390,1420
2110       GOSUB I OF 2190,2220,2240,2260,2280,2300,2320,2340,2360,2380
2120       IF I<11 THEN 2140
2130       GOSUB I-10 OF 2400,2420,2440,2460,2480
2140       C1=C1+1
2150    NEXT J
2160 NEXT I
2170 T9=0
2180 GO TO 3000
2190 A(C1)=X
2200 Height(C1)=J
2210 RETURN
2220 B(C1)=X
2230 RETURN
2240 C(C1)=X
2250 RETURN
2260 D(C1)=X
2270 RETURN
2280 E1(C1)=X
2290 RETURN
2300 E2(C1)=X
2310 RETURN
2320 E3(C1)=X
2330 RETURN
2340 E4(C1)=X
2350 RETURN
2360 E5(C1)=X
2370 RETURN
2380 E6(C1)=X
2390 RETURN
2400 E7(C1)=X
2410 RETURN
2420 E8(C1)=X
2430 RETURN
2440 E9(C1)=X
2450 RETURN
2460 F1(C1)=X
2470 RETURN
2480 F2(C1)=X
2490 RETURN
3000 PRINT "ENTER MAXIMUM LINE LENGTH ";
3010 INPUT G
```

```
3020 IF G>0 THEN 3040
3030 STOP
3040 C5=0
3050 IF T9=0 THEN 3130  !REPLOT WITH SAME PARAMETERS
3060 IF G<=3000 THEN 3100
3070 WINDOW G-1500,G,0,500
3080 VIEWPORT 10,140,6,92.5
3090 GO TO 3160
3100 WINDOW G/2,G,0,500
3110 G2=G*(130/1500)/2
3120 GO TO 3150
3130 WINDOW 0,G,0,500
3140 G2=G*(130/1500)
3150 VIEWPORT 10,G2+10,6,92.5
3160 PRINT "DEVICE No. FOR PLOTTED OUTPUT? ";
3170 INPUT P
3180 IF T9>0 THEN 3270  !REPLOT WITH SAME PARAMETERS
3190 PRINT "ENTER 1 FOR LABELS ON BS LINES OR 0 FOR NO LABELS ";
3200 INPUT Q7
3210 PRINT "COVERAGE LEVEL? ";
3220 INPUT C2
3230 IF P<>1 THEN 3270  !IF NOT PLOTTER
3240 PRINT "SPEED? ";
3250 INPUT S
3260 PRINT @1,32:"BY";S
3270 PAGE
3280 PRINT @1,17:1.125,2.576
3290 MOVE @P:0,0
3300 DRAW @P:G,0
3310 DRAW @P:G,500
3320 DRAW @P:0,500
3330 DRAW @P:0,0
3340 MOVE @P:0,150
3350 DRAW @P:G,150
3360 FOR I=0 TO G STEP 100
3370    MOVE @P:I,0
3380    RMOVE @P:0,5
3390    RDRAW @P:0,-5
3400 NEXT I
3410 FOR I=0 TO G STEP 200
3420    MOVE @P:I+21,0
3430    PRINT @P:"J_H_H_H_";I
3440 NEXT I
3450 MOVE @P:G/2,0
3460 IF T9>0 THEN 3480
3470 PRINT @P:"J_J_J_H_H_H_H_H_H_H_H_H_H_H_DESIRED LINE LENGTH (FEET)";
3480 FOR I=100 TO 500 STEP 100
3490    MOVE @P:0,I
3500    RMOVE @P:10,0
3510    RDRAW @P:-10,0
3520    RMOVE @P:0,-5
3530    PRINT @P:"H_H_H_";I
3540 NEXT I
3550 IF P=32 THEN 3630
3560 MOVE @P:0,150
3570 PRINT @P:"H_H_H_H_H_";
3580 PRINT @1,25:90
```

```
3590 IF T9>0 THEN 3610
3600 PRINT @P:"DROP HEIGHT (FEET ABOVE GROUND)"
3610 PRINT @1,25:0
3620 IF T9>0 THEN 3880
3630 MOVE @P:G/2,70
3640 SET DEGREES
3650 PRINT @P:"H_H_H_H_H_H_H_H_H_H_AIRCRAFT SAFETY LIMIT"
3660 DIM Safex(10),Safey(10)  !DRAW SAFETY LIMIT
3670 Safex(1)=0
3680 Safex(2)=G
3690 Safex(3)=G
3700 Safex(6)=G/2-140
3710 Safex(4)=0
3720 Safex(5)=0
3730 Safex(7)=G/2+145
3740 Safex(8)=G/2+145
3750 Safex(9)=G/2-140
3760 Safex(10)=G/2-140
3770 Safey(1)=0
3780 Safey(7)=75+10
3790 Safey(2)=0
3800 Safey(3)=150
3810 Safey(4)=150
3820 Safey(5)=0
3830 Safey(6)=75-10
3840 Safey(7)=75-10
3850 Safey(8)=75+10
3860 Safey(9)=75+10
3870 Safey(10)=75-10
3880 HATCH ROTATE -45
3890 HATCH SPACE 4
3900 HATCH ALIGN 10,31.95
3910 HATCH @P:Safex,Safey
3920 MOVE @P:0,500
3930 IF T9>0 THEN 3950
3940 PRINT @P:"K_      COVERAGE LEVEL: ";C2
3950 IF V6=1 THEN 3980  !V6=1 IF HIT PROBABILITY FILE HAS BEEN READ
3960 GOSUB 7000
3970 CLOSE
3980 PRINT "ENTER 1 FOR LINE HP OR 0 FOR FULL HP";
3990 INPUT Q9
4000 IF Q9=1 THEN 4050
4010 HATCH ALIGN 10,31.95
4020 HATCH ROTATE 0
4030 HATCH SPACE 0.7
4040 HATCH @P:Hx,Hy
4050 MOVE @P:Hx(1),Hy(1)
4060 DRAW @P:Hx,Hy
5000 MOVE @P:A(1),Height(1)  !DRAW STRATEGY CURVES
5010 DRAW @P:A,Height
5020 IF Q7=0 THEN 5050
5030 MOVE @P:A(15),Height(15)
5040 PRINT @P:"H_";A$
5050 REM GO TO 19100
5060 MOVE @P:B(1),Height(1)
5070 DRAW @P:B,Height
5080 IF Q7=0 THEN 5110
```

```
5090 MOVE @P:B(14),Height(14)
5100 PRINT @P:"H_";B$
5110 REM GO TO 19100
5120 MOVE @P:C(1),Height(1)
5130 DRAW @P:C,Height
5140 IF Q7=0 THEN 5170
5150 MOVE @P:C(13),Height(13)
5160 PRINT @P:"H_";C$
5170 REM GO TO 19100
5180 MOVE @P:D(1),Height(1)
5190 DRAW @P:D,Height
5200 IF Q7=0 THEN 5230
5210 MOVE @P:D(12),Height(12)
5220 PRINT @P:"H_";D$
5230 REM GO TO 19100
5240 MOVE @P:E1(1),Height(1)
5250 DRAW @P:E1,Height
5260 IF Q7=0 THEN 5290
5270 MOVE @P:E1(11),Height(11)
5280 PRINT @P:"H_";E$
5290 REM GO TO 19100
5300 MOVE @P:E2(1),Height(1)
5310 DRAW @P:E2,Height
5320 IF Q7=0 THEN 5350
5330 MOVE @P:E2(10),Height(10)
5340 PRINT @P:"H_";F$
5350 REM GO TO 19100
5360 MOVE @P:E3(1),Height(1)
5370 DRAW @P:E3,Height
5380 IF Q7=0 THEN 5410
5390 MOVE @P:E3(9),Height(9)
5400 PRINT @P:"H_";G$
5410 REM GO TO 19100
5420 MOVE @P:E4(1),Height(1)
5430 DRAW @P:E4,Height
5440 IF Q7=0 THEN 5470
5450 MOVE @P:E4(8),Height(8)
5460 PRINT @P:"H_";H$
5470 REM GO TO 19100
5480 MOVE @P:E5(1),Height(1)
5490 DRAW @P:E5,Height
5500 IF Q7=0 THEN 5530
5510 MOVE @P:E5(7),Height(7)
5520 PRINT @P:"H_";I$
5530 REM GO TO 19100
5540 MOVE @P:E6(1),Height(1)
5550 DRAW @P:E6,Height
5560 IF Q7=0 THEN 5590
5570 MOVE @P:E6(6),Height(6)
5580 PRINT @P:"H_";J$
5590 REM GO TO 19100
5600 MOVE @P:E7(1),Height(1)
5610 DRAW @P:E7,Height
5620 IF Q7=0 THEN 5650
5630 MOVE @P:E7(5),Height(5)
5640 PRINT @P:"H_";K$
5650 MOVE @P:E8(1),Height(1)
```

```
5660 DRAW @P:E8,Height
5670 IF Q7=0 THEN 5700
5680 MOVE @P:E8(4),Height(4)
5690 PRINT @P:"H_";L$
5700 MOVE @P:E9(1),Height(1)
5710 DRAW @P:E9,Height
5720 IF Q7=0 THEN 5750
5730 MOVE @P:E9(8),Height(8)
5740 PRINT @P:"H_";M$
5750 MOVE @P:F1(1),Height(1)
5760 DRAW @P:F1,Height
5770 IF Q7=0 THEN 5800
5780 MOVE @P:F1(17),Height(17)
5790 PRINT @P:"H_";N$
5800 MOVE @P:F2(1),Height(1)
5810 DRAW @P:F2,Height
5820 IF Q7=0 THEN 6000
5830 MOVE @P:F2(16),Height(16)
5840 PRINT @P:"H_";O$
6000 DIM Capx(62),Capy(62)  !DRAW NO CAPABILITY SECTION
6010 Count=1
6020 FOR J=150 TO 700 STEP 10
6030    GOSUB 1090
6040    Capx(Count)=X
6050    Capy(Count)=J
6060    Count=Count+1
6070 NEXT J
6080 Capx(55)=G
6090 Capy(55)=500
6100 Capx(56)=G
6110 Capy(56)=150
6120 Capx(57)=Capx(1)
6130 Capy(57)=150
6140 Startx=(G+D(20))/2
6150 Starty=Height(20)
6160 Capx(58)=Startx
6170 Capy(58)=Starty
6180 Capx(59)=Startx+160
6190 Capy(59)=Starty
6200 Capx(60)=Startx+160
6210 Capy(60)=Starty+35
6220 Capx(61)=Startx
6230 Capy(61)=Starty+35
6240 Capx(62)=Startx
6250 Capy(62)=Starty
6260 HATCH SPACE 4
6270 HATCH ROTATE 45
6280 HATCH ALIGN 130/1500*G+10,31.95
6290 HATCH @P:Capx,Capy
6300 MOVE @P:(G+D(20))/2+80,Height(20)+21
6310 PRINT @P:"H_NOJ_H_H_H_H_H_H_CAPABILITY"
6320 T9=1
6330 GO TO 3000
6340 END
7000 DATA 0,12.8,25.1,35.3,43.7,50.6,56.6,61.1,66,69.9,73.6,77.2,80.5
7005 Z=103
7010 DATA 83.7,86.6,89.3,91.8,94.1,96.2,98.2,100.1,101.8,103.4,104.9
```

```
7011 DATA 106.3,107.7,109,110.3,111.5,112.6,113.7,114.7,115.8,116.9,118
7012 DATA 119.1,120.2,121.3,122.5,123.7,125,126.3,127.8,129.2,130.7
7013 DATA 132.2,133.8,135.4,137.1,138.8,140.5,142.1,143.7,145.4,147.1
7014 DATA 149.1,151.1,153.1,155.1,156.8,158.3,159.9,161.5,163.2,165.1
7015 DATA 167.1,169,171,173.1,175.3,177.6,180.1,182.7,185.4,188.1,190.9
7016 DATA 193.9,196.9,200,203.1,206.4,209.8,213.3,217,220.9,224.9,229.1
7017 DATA 233.3,237.5,241.7,245.9,250.1,254.6,259.3,264.1,269,274.2
7018 DATA 279.4,284.8,290.1,295.5,0,0
7020 IF P<>1 THEN 7030
7021 GIN @1:Pause1,Pause2
7030 DIM Hx(Z),Hy(Z)
7035 RESTORE 7000
7040 FOR I=1 TO Z
7050    READ Hx(I)
7055    Hy(I)=(I-1)*5
7060 NEXT I
7080 Hy(102)=500
7081 Hy(103)=0
7090 V6=1
7100 RETURN
8000 PRINT "??  ";  !PRINT A KEYBOARD ENTERED LABEL ON PLOTTER
8010 INPUT L$
8020 PRINT @1,17:1.125,2.576
8030 PRINT @1:L$;
8040 GO TO 100
9000 PRINT "# OF TANKS-THEN # OF REPEATS-THEN # OF SECONDS? ";
9010 INPUT L,M,N$  !PRINT TXR LABEL ON PLOTTER
9020 GIN @P:P1,P2
9030 PRINT @1,32:"BY";50
9040 IF N$="0" THEN 9090
9050 PRINT @1,17:1.125,2.576
9060 PRINT @1:"H_H_";L;"Tx";M;"RJ_H_H_H_H_";N$;"s";
9070 MOVE @P:P1,P2
9080 END
9090 PRINT @1:"H_H_";L;"Tx";M;"R";
9100 MOVE @P:P1,P2
9110 END
10000 GIN @1:X8,X9  !DRAW RIGHT ARROW
10010 PRINT @1,17:1.125,2.576
10020 FOR I=0 TO 6
10030    DRAW @1:X8-15+I,X9+6-I
10040    DRAW @1:X8-15+I,X9-6+I
10050    DRAW @1:X8,X9
10060 NEXT I
10070 END
11000 GIN @1:X8,X9  !DRAW LEFT ARROW
11010 PRINT @1,17:1.125,2.576
11020 FOR I=0 TO 6
11030    DRAW @1:X8+15-I,X9+6-I
11040    DRAW @1:X8+15-I,X9-6+I
11050    DRAW @1:X8,X9
11060 NEXT I
11070 END
```

SMOOTHFOOT

This program uses data from the program LDRWIDTH and aligns the footprint data for input to FINALFOOT. Data for each gpc is entered and presented graphically on the computer for modification to eliminate crossing gpc lines, etc.

```
  1 GOTO 60000
  2 GOTO 63000
  3 END
  4 GOTO 100
  8 GOTO 1000
 12 GOTO 50000
 16 GOTO 51000
 20 GOTO 30000
 24 GOTO 10000
 28 GOTO 20000
 32 GOTO 40000
 36 GOTO 55000
 40 GOTO 1080
 76 GOTO 61000
 80 GOTO 62000
100 REM data entry section
110 DELETE L1,L2,L3,L4,L5,F1,F2,F3,F4,F5
120 DIM L1[40,2],L2[40,2],L3[40,2],L4[40,2],L5[40,2],F1[40,2],F2[40,2]
130 DIM F4[40,2],F5[40,2],F3[40,2]
140 F1 = 0
150 F2 = 0
160 F3 = 0
170 F4 = 0
180 F5 = 0
190 L1 = 0
200 L2 = 0
210 L3 = 0
220 L4 = 0
230 L5 = 0
240 CLEAR
250 PRINT "TITLE? ";
260 INPUT T$
270 T$ = "CONAIR DC-6B TANKER 454 " & T$
280 FOR I = 1 TO 40
290   PRINT "ENTER LEADING EDGE FEET THEN ALTITUDE FOR 1 GPC ";
300   INPUT L1[I,1],L1[I,2]
310   IF L1[I,1]=0 THEN 330
320 NEXT I
330 FOR I = 1 TO 40
340   PRINT "ENTER LEADING EDGE FEET THEN ALTITUDE FOR 2 GPC ";
350   INPUT L2[I,1],L2[I,2]
360   IF L2[I,1]=0 THEN 380
370 NEXT I
380 FOR I = 1 TO 40
390   PRINT "ENTER LEADING EDGE FEET THEN ALTITUDE FOR 3 GPC ";
400   INPUT L3[I,1],L3[I,2]
410   IF L3[I,1]=0 THEN 430
420 NEXT I
430 FOR I = 1 TO 40
440   PRINT "ENTER LEADING EDGE FEET THEN ALTITUDE FOR 4 GPC ";
450   INPUT L4[I,1],L4[I,2]
460   IF L4[I,1]=0 THEN 480
```

```
470 NEXT I
480 FOR I = 1 TO 40
490   PRINT "ENTER LEADING EDGE FEET THEN ALTITUDE FOR 5 GPC ";
500   INPUT L5[I,1],L5[I,2]
510   IF L5[I,1]=0 THEN 530
520 NEXT I
530 FOR I = 1 TO 40
540   PRINT "ENTER TRAILING EDGE FEET THEN ALTITUDE FOR 1 GPC ";
550   INPUT F1[I,1],F1[I,2]
560   IF F1[I,1]=0 THEN 580
570 NEXT I
580 FOR I = 1 TO 40
590   PRINT "ENTER TRAILING EDGE FEET THEN ALTITUDE FOR 2 GPC ";
600   INPUT F2[I,1],F2[I,2]
610   IF F2[I,1]=0 THEN 630
620 NEXT I
630 FOR I = 1 TO 40
640   PRINT "ENTER TRAILING EDGE FEET THEN ALTITUDE FOR 3 GPC ";
650   INPUT F3[I,1],F3[I,2]
660   IF F3[I,1]=0 THEN 680
670 NEXT I
680 FOR I = 1 TO 40
690   PRINT "ENTER TRAILING EDGE FEET THEN ALTITUDE FOR 4 GPC ";
700   INPUT F4[I,1],F4[I,2]
710   IF F4[I,1]=0 THEN 730
720 NEXT I
730 FOR I = 1 TO 40
740   PRINT "ENTER TRAILING EDGE FEET THEN ALTITUDE FOR 5 GPC ";
750   INPUT F5[I,1],F5[I,2]
760   IF F5[I,1]=0 THEN 780
770 NEXT I
780 PRINT "DATA ENTERED"
790 GOTO 60000
1000 PRINT
1030 PRINT T$
1040 PRINT "MAXIMUM LENGTH? ";
1050 INPUT M
1055 SET CLIP OFF
1060 SET VIEWPORT 10,120,10,80
1070 SET WINDOW 0,M,0,500
1080 SET LINE COLOR 15
1090 SET TEXT COLOR 15 | SET TEXT STYLE 0 | SET TEXT SIZE 12
1091 CLEAR
1095 MOVE 0,520
1100 TEXT T$
1110 PLOT AXIS 50,100
1120 FOR I = 500 TO 0 STEP -100
1130   MOVE 0,I+5
1140   TEXT ABS(I-500)
1150   MOVE 0,I
1160   DRAW M,I
1170 NEXT I
1180 FOR I = 0 TO M STEP 50
1190   MOVE I-10,0+5
1200   TEXT I
1210 NEXT I
1230 SET LINE COLOR 2
```

```
1240 MOVE 0,500
1250 FOR I = 1 TO 40
1260   IF L1[I,1]=0 THEN 1290
1270   DRAW L1[I,1],500-L1[I,2]
1280 NEXT I
1290 MOVE 0,500
1300 FOR I = 1 TO 40
1310   IF F1[I,1]=0 THEN 1350
1320   DRAW F1[I,1],500-F1[I,2]
1330 NEXT I
1350 SET LINE COLOR 3
1360 MOVE 0,500
1370 FOR I = 1 TO 40
1380   IF L2[I,1]=0 THEN 1410
1390   DRAW L2[I,1],500-L2[I,2]
1400 NEXT I
1410 MOVE 0,500
1420 FOR I = 1 TO 40
1430   IF F2[I,1]=0 THEN 1460
1440   DRAW F2[I,1],500-F2[I,2]
1450 NEXT I
1460 SET LINE COLOR 6
1480 MOVE 0,500
1490 FOR I = 1 TO 40
1500   IF L3[I,1]=0 THEN 1530
1510   DRAW L3[I,1],500-L3[I,2]
1520 NEXT I
1530 MOVE 0,500
1540 FOR I = 1 TO 40
1550   IF F3[I,1]=0 THEN 1580
1560   DRAW F3[I,1],500-F3[I,2]
1570 NEXT I
1580 SET LINE COLOR 14
1600 MOVE 0,500
1610 FOR I = 1 TO 40
1620   IF L4[I,1]=0 THEN 1650
1630   DRAW L4[I,1],500-L4[I,2]
1640 NEXT I
1650 MOVE 0,500
1660 FOR I = 1 TO 40
1670   IF F4[I,1]=0 THEN 1700
1680   DRAW F4[I,1],500-F4[I,2]
1690 NEXT I
1700 SET LINE COLOR 15
1720 MOVE 0,500
1730 FOR I = 1 TO 40
1740   IF L5[I,1]=0 THEN 1770
1750   DRAW L5[I,1],500-L5[I,2]
1760 NEXT I
1770 MOVE 0,500
1780 FOR I = 1 TO 40
1790   IF F5[I,1]=0 THEN 1820
1800   DRAW F5[I,1],500-F5[I,2]
1810 NEXT I
1820 END
10000 REM CHANGE LEADING EDGE
10010 DELETE L
```

```
10020 DIM L[40,2]
10030 HOME
10040 PRINT
10050 PRINT "GPC? ";
10060 INPUT G
10070 ON G GOSUB 10180,10200,10220,10240,10260
10080 FOR I = 1 TO 40
10090   PRINT USING "4D,X,S":L[I,1]
10100 NEXT I
10110 PRINT
10120 PRINT "WHICH ENTRY? ";
10130 INPUT E
10140 PRINT "NEW VALUE? ";
10150 INPUT L[E,1]
10160 ON G GOTO 10280,10300,10320,10340,10360
10170 END
10180 L = L1
10190 RETURN
10200 L = L2
10210 RETURN
10220 L = L3
10230 RETURN
10240 L = L4
10250 RETURN
10260 L = L5
10270 RETURN
10280 L1 = L
10290 END
10300 L2 = L
10310 END
10320 L3 = L
10330 END
10340 L4 = L
10350 END
10360 L5 = L
10370 END
20000 REM CHANGE TRAILING EDGE
20010 DELETE F
20020 DIM F[40,2]
20030 HOME
20040 PRINT
20050 PRINT "GPC? ";
20060 INPUT G
20070 ON G GOSUB 20180,20200,20220,20240,20260
20080 FOR I = 1 TO 40
20090   PRINT USING "4D,X,S":F[I,1]
20100 NEXT I
20110 PRINT
20120 PRINT "WHICH ENTRY? ";
20130 INPUT E
20140 PRINT "NEW VALUE? ";
20150 INPUT F[E,1]
20160 ON G GOTO 20280,20300,20320,20340,20360
20170 END
20180 F = F1
20190 RETURN
20200 F = F2
```

```
20210 RETURN
20220 F = F3
20230 RETURN
20240 F = F4
20250 RETURN
20260 F = F5
20270 RETURN
20280 F1 = F
20290 END
20300 F2 = F
20310 END
20320 F3 = F
20330 END
20340 F4 = F
20350 END
20360 F5 = F
20370 END
30000 REM PRINT OUT SECTION
30005 OPEN #1:"printfile","f"
30010 DELETE K1,K2,L,F
30020 DIM K1[5],K2[5],L[40,2],F[40,2]
30030 K1 = 0
30040 K2 = 0
30050 P$ = "X,4D,2X,4D,2X,S"
30060 CLEAR
30070 PRINT T$ | PRINT #1:T$
30075 PRINT | PRINT #1:
30076 PRINT | PRINT #1:
30080 PRINT "      1             2              3             4";
30081 PRINT #1:"      1             2              3             4";
30090 PRINT "             5"
30091 PRINT #1:"             5"
30100 PRINT "_____________________________________________________";
30101 PRINT #1:"_____________________________________________________";
30110 PRINT "_________"
30111 PRINT #1:"_________"
30120 FOR I = 1 TO 40
30130   IF L5[I,1]=0 AND L4[I,1]=0 AND L3[I,1]=0 AND L2[I,1]=0 THEN 30150
30140   GOTO 30160
30150   IF L1[I,1]=0 THEN EXIT TO 30230
30160   PRINT USING P$:L1[I,1],L1[I,2] | PRINT #1 USING P$:L1[I,1],L1[I,2]
30170   PRINT USING P$:L2[I,1],L2[I,2] | PRINT #1 USING P$:L2[I,1],L2[I,2]
30180   PRINT USING P$:L3[I,1],L3[I,2] | PRINT #1 USING P$:L3[I,1],L3[I,2]
30190   PRINT USING P$:L4[I,1],L4[I,2] | PRINT #1 USING P$:L4[I,1],L4[I,2]
30200   PRINT USING P$:L5[I,1],L5[I,2] | PRINT #1 USING P$:L5[I,1],L5[I,2]
30210   PRINT | PRINT #1:
30220 NEXT I
30230 FOR I = 1 TO 5
30240   ON I GOSUB 10180,10200,10220,10240,10260
30250   ON I GOSUB 20180,20200,20220,20240,20260
30260   FOR J = 1 TO 40
30270     IF L[J,1]=0 THEN EXIT TO 30290
30280   NEXT J
30290   IF J=1 THEN 30310
30300   K1[I] = L[J-1,1]
30310   FOR J = 1 TO 40
30320     IF F[J,1]=0 THEN EXIT TO 30340
```

```
30330   NEXT J
30340   IF J=1 THEN 30360
30350   K2[I] = F[J-1,1]
30360 NEXT I
30370 K1 = K2+K1
30380 K1 = K1/2
30390 FOR I = 1 TO 5
30400   PRINT USING P$:K1[I],0 | PRINT #1 USING P$:K1[I],0
30410 NEXT I
30420 PRINT | PRINT #1:
30430 FOR I = 40 TO 1 STEP -1
30440   IF F5[I,1]=0 AND F4[I,1]=0 AND F3[I,1]=0 AND F2[I,1]=0 THEN 30460
30450   GOTO 30470
30460   IF F1[I,1]=0 THEN 30530
30470   PRINT USING P$:F1[I,1],F1[I,2] | PRINT #1 USING P$:F1[I,1],F1[I,2]
30480   PRINT USING P$:F2[I,1],F2[I,2] | PRINT #1 USING P$:F2[I,1],F2[I,2]
30490   PRINT USING P$:F3[I,1],F3[I,2] | PRINT #1 USING P$:F3[I,1],F3[I,2]
30500   PRINT USING P$:F4[I,1],F4[I,2] | PRINT #1 USING P$:F4[I,1],F4[I,2]
30510   PRINT USING P$:F5[I,1],F5[I,2] | PRINT #1 USING P$:F5[I,1],F5[I,2]
30520   PRINT | PRINT #1:
30530 NEXT I
30540 CALL "lpr printfile"
30550 END
40000 PRINT "WHICH GPC? ";
40010 INPUT G
40020 ON G GOTO 1230,1350,1460,1580,1700
40030 END
50000 REM SAVE DATA ON DISC
50010 PRINT "FILE NAME? ";
50020 INPUT F$
50050 OPEN #1:F$,"F"
50060 WRITE #1:T$,L1,L2,L3,L4,L5,F1,F2,F3,F4,F5
50070 CLOSE
50080 END
51000 REM RECALL STORED DATA
51010 DELETE L1,L2,L3,L4,L5,F1,F2,F3,F4,F5
51020 DIM L1[40,2],L2[40,2],L3[40,2],L4[40,2],L5[40,2],F1[40,2],F2[40,2]
51030 DIM F4[40,2],F5[40,2],F3[40,2]
51040 PRINT "FILE NAME TO BE RECALLED? ";
51050 INPUT F$
51060 OPEN #1:F$,"R"
51070 READ #1:T$,L1,L2,L3,L4,L5,F1,F2,F3,F4,F5
51080 CLOSE
51090 END
55000 PRINT "WHICH GPC? ";
55010 INPUT G
55020 PRINT "WHAT HEIGHT? ";
55030 INPUT H
55040 PRINT "WHAT AMOUNT? ";
55050 INPUT A
55060 ON G GOTO 55100,55200,55300,55400,55500
55070 PRINT "REENTER"
55080 STOP
55100 L1[H/100,1] = L1[H/100,1]+A
55110 F1[H/100,1] = F1[H/100,1]+A
55120 END
55200 L2[H/100,1] = L2[H/100,1]+A
```

```
55210 F2[H/100,1] = F2[H/100,1]+A
55220 END
55300 L3[H/100,1] = L3[H/100,1]+A
55310 F3[H/100,1] = F3[H/100,1]+A
55320 END
55400 L4[H/100,1] = L4[H/100,1]+A
55410 F4[H/100,1] = F4[H/100,1]+A
55420 END
55500 L5[H/100,1] = L5[H/100,1]+A
55510 F5[H/100,1] = F5[H/100,1]+A
55520 END
60000 SET DIALOG COLOR 3
60005 PRINT "USER DEFINABLE KEY  1: ENTER DATA"
60010 PRINT "                    2: DRAW DATA SET"
60020 PRINT "                    3: STORE DATA"
60030 PRINT "                    4: RECALL DATA"
60040 PRINT "                    5: PRINT RESULTS"
60050 PRINT "                    6: CHANGE LEADING EDGE"
60060 PRINT "                    7: CHANGE TRAILING EDGE"
60070 PRINT "                    8: DRAW ANY ONE GPC"
60075 PRINT "                    9: CHANGE BOTH LEADING AND TRAILING"
60080 PRINT "                   10: REDRAW DATA SET"
60090 PRINT "                   19: RECALL A PATDAT FILE"
60100 PRINT "                   20: SAVE THE RECALLED PATDAT FILE"
60110 END
61000 PRINT "FILE? ";
61010 DELETE M1,M2
61020 DIM M1[40],M2[8]
61030 INPUT F$
61040 F$ = "PATDAT" & F$
61050 OPEN #1:F$,"R"
61060 READ #1:M1,M2
61070 CLOSE
61075 CLEAR
61079 FOR J = 0 TO 30 STEP 10
61080   FOR I = 1 TO 10
61081     PRINT USING "3D.3D,S":M1[I+J]
61082   NEXT I
61083   PRINT
61084 NEXT J
61090 SET WINDOW 0,40,0,15
61100 SET VIEWPORT 10,120,10,50
61110 MOVE 0,0
61120 DRAW 40,0
61130 MOVE 0,0
61140 FOR I = 1 TO 40
61150   DRAW I,M1[I]
61160 NEXT I
61170 MOVE 0,1
61180 DRAW 30,1
61190 SET TEXT COLOR 2 | TEXT 1
61200 MOVE 0,2
61210 DRAW 30,2
61220 SET TEXT COLOR 3 | TEXT 2
61230 MOVE 0,3
61240 DRAW 30,3
61250 SET TEXT COLOR 6 | TEXT 3
```

```
61260 MOVE 0,4
61270 DRAW 30,4
61280 SET TEXT COLOR 14 | TEXT 4
61290 MOVE 0,5
61300 DRAW 30,5
61310 SET TEXT COLOR 15 | TEXT 5
61320 MOVE 12,15
61330 TEXT F$
61340 END
62000 OPEN #1:F$,"F"
62010 WRITE #1:M1,M2
62020 CLOSE
62030 END
```

FINAL FOOT

This program accepts data for footprint and width and draws the footprint camera ready on a plotter. Inputs are width for line lengths of 1, 2, 3, 4, and 5 gpc at 100-foot drop height intervals, tension, and downrange position of the footprints.

Tension is the tightness of the smoothing of the data through the points, the lower the value entered, the looser the fit, for most guidelines a value of 1.0 appears to be best.

The length portion of the footprints for each gpc always starts at 0,0 then the value at 100 feet, 200, etc., to 500 feet; then starts up the right side of the footprint at 500 feet, 400 feet, etc. The next to last point is 0 feet and the distance the aircraft flies while the tanks are emptying (evacuation time x speed in feet per second), with the last point being 0,0.

Two files, SIDE and END, containing a digitized outline of the side and end view of the aircraft must also be available to the program. Each is organized as $N, X_1 X_2,,,, X_N):Y_1, Y_2,,,, Y_N$. where N is the number of X, Y data points.

```
1 GO TO 2000
4 GO TO 100
8 GO TO 1000
12 GO TO 1090
16 GO TO 1900
20 K9=0
21 VIEWPORT G8,G9,20,60
22 WINDOW 0,90,0,500
23 GO TO 2500
24 GO TO 2300
28 PRINT "WHAT GPC? ";
29 INPUT Cgpc
30 GO TO Cgpc OF 7500,7600,7700,7800,7900
32 GO TO 5500
36 GO TO 1700
40 GO TO 8200
44 GO TO 6200
48 GO TO 8000
52 GO TO 60000
56 GO TO 63000
60 GO TO 65000
64 GO TO 64000
80 PRINT "ARRAY?";
81 INPUT Ard
82 GO TO Ard OF 51000,52000,53000,54000,55000
89 END
90 DELETE A$
91 DIM A$(300)
92 CALL "MOUNT",0,A$
93 PRINT A$
94 END
100 PAGE
```

```
110 PRINT "INPUT WIDTHS:  GIVE WIDTH FOR EACH CONCENTRATION AT EACH"
120 PRINT "ALTITUDE.  IF NO WIDTH FOR GIVEN ALTITUDE ENTER 0."
130 DIM X1(6),X2(6),X3(6),X4(6),Y1(6),Y2(6),Y3(6),Y4(6),Y9(6)
140 DIM C1(6),C2(6),H1(6),H2(6),H3(6),H4(6),P(20)
150 P9=19
160 X1(1)=0
170 X2(1)=0
180 X3(1)=0
190 X4(1)=0
200 H1(1)=0
210 IMAGE "INPUT WIDTHS FOR ",D," GPC"
220 PRINT USING 210:1
230 FOR I=2 TO 6
240    PRINT (I-1)*100;" FEET ";
250    INPUT X1(I)
260 NEXT I
270 PRINT USING 210:2
280 FOR I=2 TO 6
290    PRINT (I-1)*100;" FEET ";
300    INPUT X2(I)
310 NEXT I
320 PRINT USING 210:3
330 FOR I=2 TO 6
340    PRINT (I-1)*100;" FEET ";
350    INPUT X3(I)
360 NEXT I
370 PRINT USING 210:4
380 FOR I=2 TO 6
390    PRINT (I-1)*100;" FEET ";
400    INPUT X4(I)
410 NEXT I
420 PRINT USING 210:5
430 FOR I=2 TO 6
440    PRINT (I-1)*100;" FEET ";
450    INPUT H1(I)
460 NEXT I
470 X1=X1/2
480 X2=X2/2
490 X3=X3/2
500 X4=X4/2
510 H1=H1/2
520 FOR I=1 TO 6
530    Y9(I)=(I-1)*100
540 NEXT I
550 Y1=500-Y9
560 Y2=Y1
570 Y3=Y1
580 Y4=Y1
590 H2=Y1
600 PRINT "INPUT TENSION (0<T<100)";
610 INPUT P(2)
620 PAGE
630 DELETE X5,Y5,X6,Y6,X7,Y7,X8,Y8,X9,Y9,A2
640 DIM A2(40,2)
650 FOR J=1 TO 5
660    K=0
670    FOR I=1 TO 40
```

```
680       PRINT "ENTER DISTANCE DOWN RANGE THEN DROP HEIGHT FOR ";J;" GP
          C ";
690       INPUT A2(I,1),A2(I,2)
700       A2(I,2)=500-A2(I,2)
710       IF A2(I,2)>501 THEN 740
720       K=K+1
730    NEXT I
740    GOSUB J OF 6670,6800,6910,7020,7130
750    PAGE
760 NEXT J
770 END
1000 PAGE
1010 PRINT "WHAT IS THE LENGTH OF THE GRAPH? ";
1020 INPUT L
1030 PRINT "NUMBER OF COMPARTMENTS? ";
1040 INPUT T$
1050 PRINT "NUMBER OF GALLONS? ";
1060 INPUT L2
1070 REM PRINT "AFTER CPT LABEL? ";
1080 REM INPUT L$
1090 PRINT "ENTER 1 FOR PLOTTER, 32 FOR SCREEN";
1100 INPUT D
1110 Q9=D
1120 IF D<>1 THEN 1200
1130 PRINT "ENTER PLOTTER SPEED: ";
1140 INPUT By
1150 PRINT @1,32:"BY",By
1200 PAGE
1210 REM G8=L/6.29921259843+25
1211 G8=18+L*112/1000
1220 G9=G8+8.74285714286*(1300/800)
1221 G9=90/1000*112+G8
1230 GOSUB 6370
1250 WINDOW 0,1000,0,500
1260 PRINT @1,17:1.125,2.576
1270 VIEWPORT 12,124,20,60
1280 FOR I=500 TO 0 STEP -100
1290    MOVE @D:0,I
1300    RDRAW @D:L,0
1310    RDRAW @D:-L,0
1340    RMOVE @D:0,-5
1350    PRINT @D:"H_H_H_";500-I
1360 NEXT I
1370 MOVE @D:0,0
1380 DRAW @D:0,500
1390 DRAW @D:0,0
1400 Z7=1
1410 FOR I=50 TO L STEP 50
1420    MOVE @D:I,0
1430    IF Z7=3 THEN 1480
1440    RDRAW @D:0,6
1450    RDRAW @D:0,-6
1460    Z7=Z7+1
1470    GO TO 1530
1480    RDRAW @D:0,12
1490    RDRAW @D:0,-12
1500    RDRAW @D:-2.0
```

```
1510    PRINT @D:"J_H_";I
1520    Z7=1
1530 NEXT I
1540 MOVE @D:L/2,0
1550 PRINT @D:"J_J_H_H_H_H_H_H_H_H_H_H_H_H_H_H_H_H_RANGE AND PATTERN LENGTH (FEET)"
1560 IF D=1 THEN 1580
1570 GO TO 1640
1580 MOVE @1:0,250
1590 PRINT "H_H_H_H_"
1600 SET DEGREES
1610 PRINT @1,25:90
1620 PRINT @D:"K_K_H_H_H_H_H_H_H_H_H_H_H_H_H_H_H_DROP HEIGHT (FEET ABOVE GROUND)"
1630 PRINT @1,25:0
1640 MOVE @D:20,500
1650 PRINT @D:"K_   ";T$;" ";L2;"-GALLON DROP"
1659 PRINT "G_G_G_G_"
1660 END
1700 VIEWPORT G8,G9,20,60
1710 WINDOW 0,90,0,500
1720 AXIS @D:30,500
1725 PRINT @1,17:1.125,2.576
1730 MOVE @D:0,0
1740 PRINT @D:"J_0"
1750 FOR I=30 TO 60 STEP 30
1760    MOVE @D:I,0
1770    RDRAW @D:0,10
1780    RDRAW @D:0,-10
1790    PRINT @D:"J_H_";I
1800 NEXT I
1810 MOVE @D:0,0
1820 PRINT @D:"J_J_HALF-WIDTHJ_H_H_H_H_H_H_H_H_(FEET)"
1830 FOR I=100 TO 500 STEP 100
1840    MOVE @D:0,I
1850    RDRAW @D:90,0
1860    RDRAW @D:-90,0
1870 NEXT I
1880 PRINT "G_"
1890 END
1900 WINDOW 0,1000,0,500
1910 VIEWPORT 12,124,20,60
1920 MOVE @D:0,500
1930 K9=1
1940 O7=1
1950 GO TO 2500
1960 END
2000 PAGE
2010 DIM P(20)
2020 C9=0
2030 PRINT "USER DEFINABLE KEYS:"
2040 PRINT
2050 PRINT " 1   ENTER DATA (WIDTHS, TENSION, FILE #'S, etc.)"
2060 PRINT " 2   ENTER PARAMETERS FOR AXES AND DRAW"
2070 PRINT " 3   DRAW AXES FROM PREVIOUSLY ENTERED PARAMETERS"
2080 PRINT " 4   DRAW FOOTPRINTS"
2090 PRINT " 5   DRAW WIDTHS"
2100 PRINT " 6   PRINT LABELS ON PLOTTER"
2110 PRINT " 7   INSERT VALUE INTO ANY GPC FOOTPRINT "
```

```
2120 PRINT " 8   PRINT DATA ON PRINTER"
2130 PRINT " 9   DRAW WIDTH PORTION OF AXES"
2140 PRINT "10   PRINT ID ON LOWER LEFT OF GRAPH"
2150 PRINT "11   PRINT LABELS ON WIDTH CHART WITH LINES"
2160 PRINT "12   PRINT * STATEMENT ON GRAPH"
2165 PRINT "13   PRINT X'S ON FOOTPRINT"
2170 PRINT "14   PRINT X'S ON HALFWIDTH"
2180 PRINT "15   SAVE ENTERED DATA ON SISC "
2181 PRINT "16   RECALL ENTERED DATA FROM DISC "
2189 PRINT "20   CHANGE FOOT PRINT ARRAY"
2190 END
2300 PAGE
2310 PRINT "PRESS RETURN WITH NO ENTRY TO EXIT THIS ROUTINE"
2320 PRINT "POSITION PEN THEN INPUT LABEL AND HIT RETURN. "
2321 PRINT @1,17:1.125,2.576
2330 PRINT
2340 PRINT "INPUT LABEL:";
2350 INPUT A$
2360 IF A$="" THEN 2390
2370 PRINT @D:A$;"H_";A$;"H_";
2380 GO TO 2340
2390 END
2400 P(12)=1
2500 DELETE X,Y,C1,C2
2540 O7=1
2550 IF K9=1 THEN 8260
2560 MOVE @D:0,500
2570 N=6
2580 DIM X(6),Y(6),C1(6),C2(6)
2590 P(12)=1
2600 GO TO O7 OF 4330,4390,4430,4470,4510,4550
2610 END
2620 GO TO O7 OF 8280,8370,8460,8560,8650,8740
2630 DELETE P8
2635 IF N=1 THEN 4550
2636 Adot=SUM(X)
2637 IF Adot=0 THEN 4550
2640 DIM P8(N)
2650 P3=X(2)-X(1)
2660 P5=Y(2)-Y(1)
2670 Q1=SQR(P3*P3+P5*P5)
2680 Q3=P3/Q1
2690 Q5=P5/Q1
2700 IF N>2 THEN 2750
2710 C1=0
2720 C2=0
2730 GO TO 3560
2740 REM  ***FIND SLOPES AT ENDPOINTS***
2750 P2=SQR((X(3)-X(2))^2+(Y(3)-Y(2))^2)
2760 Q4=Q1+P2
2770 P3=-(Q4+Q1)/(Q4*Q1)
2780 P4=Q4/(Q1*P2)
2790 P5=-Q1/(Q4*P2)
2800 P1=P3*X(1)+P4*X(2)+P5*X(3)
2810 P2=P3*Y(1)+P4*Y(2)+P5*Y(3)
2820 P3=SQR(P1*P1+P2*P2)
2830 C1(1)=Q3-P1/P3
```

```
2840 C2(1)=Q5-P2/P3
2850 P2=SQR((X(N-2)-X(N-1))^2+(Y(N-2)-Y(N-1))^2)
2860 P6=SQR((X(N)-X(N-1))^2+(Y(N)-Y(N-1))^2)
2870 Q4=P2+P6
2880 P3=(Q4+P6)/(Q4*P6)
2890 P4=-Q4/(P6*P2)
2900 P5=P6/(Q4*P2)
2910 C1(N)=P3*X(N)+P4*X(N-1)+P5*X(N-2)
2920 C2(N)=P3*Y(N)+P4*Y(N-1)+P5*Y(N-2)
2930 REM  ***SET UP TRI-DIAGONAL SYSTEM***
2940 P8(1)=Q1
2950 Q6=Q1
2960 IF N<3 THEN 3120
2970 P2=2
2980 FOR P1=3 TO N
2990    P3=X(P1)-X(P2)
3000    P5=Y(P1)-Y(P2)
3010    Q2=SQR(P3*P3+P5*P5)
3020    P4=P3/Q2
3030    P6=P5/Q2
3040    C1(P2)=P4-Q3
3050    C2(P2)=P6-Q5
3060    P8(P2)=Q2
3070    Q3=P4
3080    Q5=P6
3090    Q6=Q6+Q2
3100    P2=P1
3110 NEXT P1
3120 P(11)=Q6
3130 P3=SQR(C1(N)^2+C2(N)^2)
3140 C1(N)=C1(N)/P3-Q3
3150 C2(N)=C2(N)/P3-Q5
3160 REM  ***UN-NORMALIZE TENSION FACTOR***
3170 P0=ABS(P(2))*(N-1)/Q6
3180 REM  ***FORWARD ELIMINATION***
3190 P3=P0*P8(1)
3200 P4=EXP(P3)
3210 P5=0.5*(P4-1/P4)
3220 P6=1/(P8(1)*P5)
3230 Q1=P6*(P3*0.5*(P4+1/P4)-P5)
3240 Q5=1/Q1
3250 C1(1)=Q5*C1(1)
3260 C2(1)=Q5*C2(1)
3270 Q4=P6*(P5-P3)
3280 P8(1)=Q5*Q4
3290 IF N<3 THEN 3450
3300 P2=1
3310 FOR P1=2 TO N-1
3320    P3=P0*P8(P1)
3330    P4=EXP(P3)
3340    P5=0.5*(P4-1/P4)
3350    P6=1/(P8(P1)*P5)
3360    Q2=P6*(P3*0.5*(P4+1/P4)-P5)
3370    Q5=1/(Q1+Q2-Q4*P8(P2))
3380    C1(P1)=Q5*(C1(P1)-Q4*C1(P2))
3390    C2(P1)=Q5*(C2(P1)-Q4*C2(P2))
3400    Q4=P6*(P5-P3)
```

```
3410    P8(P1)=Q5*Q4
3420    Q1=Q2
3430    P2=P1
3440 NEXT P1
3450 P2=N-1
3460 Q5=1/(Q1-Q4*P8(P2))
3470 C1(N)=Q5*(C1(N)-Q4*C1(P2))
3480 C2(N)=Q5*(C2(N)-Q4*C2(P2))
3490 REM  ******BACK SUBSTITUTION*********************
3500 P2=N
3510 FOR P1=N-1 TO 1 STEP -1
3520    C1(P1)=C1(P1)-P8(P1)*C1(P2)
3530    C2(P1)=C2(P1)-P8(P1)*C2(P2)
3540    P2=P1
3550 NEXT P1
3560 P(13)=P9
3570 DELETE P8
3580 GO TO 3680
3590 IF P9<>19 THEN 3540
3600 GOSUB 64
3610 GO TO 2600
3620 END
3630 GO TO 8 OF 4560,4630,4700,4770,4840,39000
3640 IF P9>19 THEN 100
3650 P9=P9+30
3660 GOSUB 16
3670 REM
3680 REM
3690 P5=0
3700 GOSUB 3900
3710 REM
3720 DELETE I1,I2
3730 DIM I1(400),I2(400)
3740 I1=0
3750 I2=0
3760 FOR P1=1 TO 400
3770    P5=P5+P0
3780    GOSUB 3900
3790    I1(P1)=P6
3800    I2(P1)=P7
3810 NEXT P1
3820 DRAW @D:I1,I2
3821 REM ****************ABOVE IS DRAW ROUTINE************
3840 MOVE @D:0,0
3850 DRAW @D:0,500
3870 IF K9=1 THEN 2620
3880 GO TO 2600
3890 END
3900 Q5=ABS(P(2))*(N-P(12))/P(11)
3910 Q7=ABS(P5*P(11))
3920 IF P5<0 THEN 4000
3930 P3=2
3940 P4=0
3950 IF P5>0 THEN 4000
3960 IF P(12)=0 THEN 4000
3970 P6=X(1)
3980 P7=Y(1)
```

```
3990 RETURN
4000 IF P3=1 THEN 4200
4010 REM  ***DETERMINE WHICH SEGMENT P5 IS MAPPED INTO***
4020 Q8=P3-1
4030 FOR Q6=P3 TO N
4040    Q1=X(Q6)-X(Q8)
4050    Q2=Y(Q6)-Y(Q8)
4060    Q3=SQR(Q1*Q1+Q2*Q2)
4070    IF P4+Q3=>Q7 THEN 4180
4080    P4=P4+Q3
4090    Q8=Q6
4100 NEXT Q6
4110 IF P(12)=0 THEN 4150
4120 P6=X(N)
4130 P7=Y(N)
4140 RETURN
4150 Q6=1
4160 Q8=N
4170 Q3=P(11)-P4
4180 P3=Q6
4190 REM  ***PERFORM INTERPOLATION***
4200 Q1=Q7-P4
4210 Q2=Q3-Q1
4220 Q4=EXP(Q5*Q1)
4230 Q6=0.5*(Q4-1/Q4)
4240 Q5=EXP(Q5*Q2)
4250 Q7=0.5*(Q5-1/Q5)
4260 Q5=Q4*Q5
4270 Q5=0.5*(Q5-1/Q5)
4280 P6=(C1(P3)*Q6+C1(Q8)*Q7)/Q5
4290 P6=P6+((X(P3)-C1(P3))*Q1+(X(Q8)-C1(Q8))*Q2)/Q3
4300 P7=(C2(P3)*Q6+C2(Q8)*Q7)/Q5
4310 P7=P7+((Y(P3)-C2(P3))*Q1+(Y(Q8)-C2(Q8))*Q2)/Q3
4320 RETURN
4330 DELETE X
4340 DIM X(6)
4350 X=X1
4360 Y=Y1
4370 O7=2
4380 GO TO 2630
4390 X=X2
4400 Y=Y2
4410 O7=3
4420 GO TO 2630
4430 X=X3
4440 Y=Y3
4450 O7=4
4460 GO TO 2630
4470 X=X4
4480 Y=Y4
4490 O7=5
4500 GO TO 2630
4510 X=H1
4520 Y=H2
4530 O7=6
4540 GO TO 2630
4550 END
```

```
4560 DELETE X,Y
4570 DIM X(N5),Y(N5)
4580 N=N5
4590 X=X5
4600 Y=Y5
4610 O8=2
4620 GO TO 11410
4630 DELETE X,Y
4640 DIM X(N6),Y(N6)
4650 N=N6
4660 X=X6
4670 Y=Y6
4680 O8=3
4690 GO TO 11410
4700 DELETE X,Y
4710 DIM X(N7),Y(N7)
4720 N=N7
4730 X=X7
4740 Y=Y7
4750 O8=4
4760 GO TO 11410
4770 DELETE X,Y
4780 DIM X(N8),Y(N8)
4790 N=N8
4800 X=X8
4810 Y=Y8
4820 O8=5
4830 GO TO 11410
4840 END
4850 N=N5
4860 GO TO 11220
4870 N=N6
4880 GO TO 11220
4890 N=N7
4900 GO TO 11220
4910 N=N8
4920 GO TO 11220
4930 END
4940 GO TO 1106
4950 VIEWPORT G8,G9,20,60
4960 PRINT 13931
4970 GO TO 1350
4980 VIEWPORT 12,124,20,60
4990 PRINT 13951
5000 GO TO 19
5010 VIEWPORT G8,G9,20,60
5020 PRINT 13971
5030 GO TO 67
5040 VIEWPORT 12,124,20,60
5050 PRINT 13991
5060 GO TO 8200
5070 VIEWPORT G8,G9,20,60
5080 PRINT 14011
5090 WINDOW 0,90,0,500
5100 GO TO 2500
5110 REM WHAT IS THIS FOR?** FIND 9
5120 REM                    * INPUT @33:A$
```

```
5130 REM                    * PRINT A$
5140 REM                    * GO TO 5120
5150 REM ***Subroutine to determine smallest x vlue in array***
5160 M=500
5170 FOR I=1 TO C
5180    M=M MIN A2(I,2)
5190 NEXT I
5200 RETURN
5500 PAGE
5501 PRINT "RET TYPE? ";
5510 INPUT R$
5512 PRINT "J_DEVICE? ";
5514 INPUT D1
5530 PRINT @D1:"L_J_J_J_K_K_";"  ";T$;" ";L2;"-GALLON DROP ";R$
5540 PRINT @D1:"J_J_         WIDTHSJ_"
5550 FOR I=2 TO 6
5560    PRINT @D1: USING 5980:X1(I)*2,X2(I)*2,X3(I)*2,X4(I)*2,H1(I)*2
5570    PRINT @D1: USING 6010:500-Y1(I),500-Y2(I),500-Y3(I),500-Y4(I)
5580    PRINT @D1: USING 5990:500-H2(I)
5590    PRINT @D1:"-------------------------"
5600 NEXT I
5610 DELETE J$
5620 DIM J$(132)
5630 J$="    |        |        |        |        |        |        |"
5640 J$=J$&"        |        |        |        |        |        |"
5650 J$=J$&"        |"
5660 PRINT @D1:"J_J_   DOWNRANGES & HEIGHTSJ_"
5670 FOR I=2 TO N5
5680    PRINT @D1: USING 6000:X5(I,1),"|",500-X5(I,2)
5690 NEXT I
5700 PRINT @D1:
5710 PRINT @D1:J$
5720 FOR I=2 TO N6
5730    PRINT @D1: USING 6000:X6(I,1),"|",500-X6(I,2)
5740 NEXT I
5750 PRINT @D1:
5760 PRINT @D1:J$
5770 FOR I=2 TO N7
5780    PRINT @D1: USING 6000:X7(I,1),"|",500-X7(I,2)
5790 NEXT I
5800 PRINT @D1:
5810 PRINT @D1:J$
5820 FOR I=2 TO N8
5830    PRINT @D1: USING 6000:X8(I,1),"|",500-X8(I,2)
5840 NEXT I
5850 PRINT @D1:
5860 PRINT @D1:J$
5870 FOR I=2 TO N9
5880    PRINT @D1: USING 6000:X9(I,1),"|",500-X9(I,2)
5890 NEXT I
5900 PRINT @D1:
5910 PRINT @D1:J$
5920 FOR I=1 TO 132
5930    PRINT @D1:"_";
5940 NEXT I
5950 PRINT @D1:
5970 END
```

```
5980 IMAGE 5(5D)
5990 IMAGE 5D
6000 IMAGE 4D,A,3D,X,S
6010 IMAGE 4(5D),S
6020 END
6030 INPUT @33:A$
6200 REM DRAW HORIZ LINES AND PRINT GPC ON WIDTH
6205 Ard=0
6210 PRINT @1,17:1.125,2.576
6220 PRINT "POSITION PEN WHERE CHARACTER WILL BE WRITTEN THEN RETURN";
6230 INPUT Q$
6240 GIN @1:H8,H9
6250 PRINT "POSITION PEN ON GRAPH & ENTER CHARACTER TO BE PRINTED"
6260 PRINT "RETURN WITH NO CHARACTER TO EXIT"
6270 INPUT Q$
6290 IF Q$="" THEN 6360
6295 GIN @1:H6,H7
6300 DRAW @1:H8,H9
6330 RMOVE @1:5,-5
6340 PRINT @1:Q$;
6345 MOVE @1:H6,H7
6346 IF Ard=1 THEN 6200
6347 Ard=1
6348 GO TO 6300
6350 GO TO 6200
6360 END
6370 IF C9=1 THEN 6440
6380 OPEN "C123SIDE";1,"R",Z$
6390 READ #1:S6
6410 DELETE Side1,Side2
6420 DIM Side1(S6),Side2(S6)
6425 FOR I=1 TO S6
6430    READ #1:Side1(I),Side2(I)
6435 NEXT I
6436 CLOSE
6437 Side2=Side2+14
6440 VIEWPORT 0,24,60,84
6445 V7=24/112*1000/2
6450 WINDOW -V7,V7,0,V7*2
6460 MOVE @D:Side1(1),Side2(1)
6480 DRAW @D:Side1,Side2
6485 HATCH ROTATE 0
6486 HATCH SPACE 0.1
6491 HATCH @D:Side1,Side2
6520 IF C9=1 THEN 6600
6530 OPEN "C123END";2,"R",Z$
6540 READ #2:S8
6570 DIM Ue1(S8),Ue2(S8)
6571 Ue1=0
6572 Ue2=0
6575 FOR I=1 TO S8
6580    READ #2:Ue1(I),Ue2(I)
6581 NEXT I
6582 CLOSE
6584 Ue2=Ue2+14
6590 C9=1
6600 VIEWPORT G8-12,G8+12,60,84
```

```
6610 REM WINDOW -78.26,78.26,0,139.13
6611 WINDOW -V7,V7,0,V7*2
6620 MOVE @D:Ue1(1),Ue2(1)
6640 DRAW @D:Ue1,Ue2
6650 HATCH @D:Ue1,Ue2
6660 RETURN
6670 DIM X5(K,2)
6690 FOR I=1 TO K
6700    X5(I,1)=A2(I,1)
6710    X5(I,2)=A2(I,2)
6730 NEXT I
6740 C=K
6750 N5=K
6760 GOSUB 5160
6770 IF M<0 THEN 6790
6780 Y1(INT((500-M)/100+2))=M
6790 RETURN
6800 DIM X6(K,2)
6810 FOR I=1 TO K
6820    X6(I,1)=A2(I,1)
6830    X6(I,2)=A2(I,2)
6840 NEXT I
6850 N6=K
6860 C=K
6870 GOSUB 5160
6880 IF M<0 THEN 6900
6890 Y2(INT((500-M)/100+2))=M
6900 RETURN
6910 DIM X7(K,2),Y7(K,2)
6920 FOR I=1 TO K
6930    X7(I,1)=A2(I,1)
6940    X7(I,2)=A2(I,2)
6950 NEXT I
6960 N7=K
6970 C=K
6980 GOSUB 5160
6990 IF M<0 THEN 7010
7000 Y3(INT((500-M)/100+2))=M
7010 RETURN
7020 DIM X8(K,2),Y8(K,2)
7030 FOR I=1 TO K
7040    X8(I,1)=A2(I,1)
7050    X8(I,2)=A2(I,2)
7060 NEXT I
7070 N8=K
7080 C=K
7090 GOSUB 5160
7100 IF M<0 THEN 7120
7110 Y4(INT((500-M)/100+2))=M
7120 RETURN
7130 DIM X9(K,2),Y9(K,2)
7140 FOR I=1 TO K
7150    X9(I,1)=A2(I,1)
7160    X9(I,2)=A2(I,2)
7170 NEXT I
```

```
7180 N9=K
7190 C=K
7200 GOSUB 5160
7210 IF M<0 THEN 7230
7220 H2(INT((500-M)/100+2))=M
7230 RETURN
7500 PRINT "J_J_AFTER WHAT POSITION? ";
7501 INPUT O2
7502 DELETE O1
7503 DIM O1(N5+1,2)
7504 FOR I=1 TO O2
7505    O1(I,1)=X5(I,1)
7506    O1(I,2)=X5(I,2)
7507 NEXT I
7508 PRINT "J_ENTER DOWNRANGE THEN HEIGHT TO BE INSERTED? "
7509 INPUT O1(O2+1,1),O1(O2+1,2)
7510 FOR I=O2+2 TO N5+1
7511    O1(I,1)=X5(I-1,1)
7512    O1(I,2)=X5(I-1,2)
7513 NEXT I
7514 DELETE X5
7515 DIM X5(N5+1,2)
7516 X5=O1
7517 N5=N5+1
7518 END
7519 FOR I=1 TO 5
7520    O1(I,1)=X9(I,1)
7521    O1(I,2)=X9(I,2)
7522 NEXT I
7523 END
7600 PRINT "J_J_AFTER WHAT POSITION? ";
7601 INPUT O2
7602 DELETE O1
7603 DIM O1(N6+1,2)
7604 FOR I=1 TO O2
7605    O1(I,1)=X6(I,1)
7606    O1(I,2)=X6(I,2)
7607 NEXT I
7608 PRINT "J_ENTER DOWNRANGE THEN HEIGHT TO BE INSERTED? "
7609 INPUT O1(O2+1,1),O1(O2+1,2)
7610 FOR I=O2+2 TO N6+1
7611    O1(I,1)=X6(I-1,1)
7612    O1(I,2)=X6(I-1,2)
7613 NEXT I
7614 DELETE X6
7615 DIM X6(N6+1,2)
7616 X6=O1
7617 N6=N6+1
7618 END
7700 PRINT "J_J_AFTER WHAT POSITION? ";
7701 INPUT O2
7702 DELETE O1
7703 DIM O1(N7+1,2)
7704 FOR I=1 TO O2
7705    O1(I,1)=X7(I,1)
7706    O1(I,2)=X7(I,2)
7707 NEXT I
```

```
7708 PRINT "J_ENTER DOWNRANGE THEN HEIGHT TO BE INSERTED? '
7709 INPUT O1(O2+1,1),O1(O2+1,2)
7710 FOR I=O2+2 TO N7+1
7711    O1(I,1)=X7(I-1,1)
7712    O1(I,2)=X7(I-1,2)
7713 NEXT I
7714 DELETE X7
7715 DIM X7(N7+1,2)
7716 X7=O1
7717 N7=N7+1
7718 END
7800 PRINT "J_J_AFTER WHAT POSITION? ";
7801 INPUT O2
7802 DELETE O1
7803 DIM O1(N8+1,2)
7804 FOR I=1 TO O2
7805    O1(I,1)=X8(I,1)
7806    O1(I,2)=X8(I,2)
7807 NEXT I
7808 PRINT "J_ENTER DOWNRANGE THEN HEIGHT TO BE INSERTED? "
7809 INPUT O1(O2+1,1),O1(O2+1,2)
7810 FOR I=O2+2 TO N8+1
7811    O1(I,1)=X8(I-1,1)
7812    O1(I,2)=X8(I-1,2)
7813 NEXT I
7814 DELETE X8
7815 DIM X8(N8+1,2)
7816 X8=O1
7817 N8=N8+1
7818 END
7900 PRINT "J_J_AFTER WHAT POSITION? ";
7901 INPUT O2
7902 DELETE O1
7903 DIM O1(N9+1,2)
7904 FOR I=1 TO O2
7905    O1(I,1)=X9(I,1)
7906    O1(I,2)=X9(I,2)
7907 NEXT I
7908 PRINT "J_ENTER DOWNRANGE THEN HEIGHT TO BE INSERTED? "
7909 INPUT O1(O2+1,1),O1(O2+1,2)
7910 FOR I=O2+2 TO N9+1
7911    O1(I,1)=X9(I-1,1)
7912    O1(I,2)=X9(I-1,2)
7913 NEXT I
7914 DELETE X9
7915 DIM X9(N9+1,2)
7916 X9=O1
7917 N9=N9+1
7918 END
8000 WINDOW 0,1000,0,500
8010 VIEWPORT 12,124,20,60
8020 MOVE @D:0,0
8030 PRINT @1,17:0.9,2.1
8040 PRINT @D:"J_J_J_J_J_J_* INDICATES COVERAGE LEVELS ABOVE ";
8050 PRINT @D:"5 GAL/100 SQ. FT."
8060 PRINT @1,17:1.125,2.576
8070 END
```

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8200 PAGE
8210 PRINT "ENTER LABEL: ";
8220 INPUT N$
8230 MOVE @1:-720,-410
8240 PRINT @1:N$
8250 END
8260 P(12)=1
8270 GO TO 2620
8280 DELETE X,Y,C1,C2
8290 DIM X(N5),Y(N5),C1(N5),C2(N5)
8300 N=N5
8310 O7=2
8320 FOR I=1 TO N
8330    X(I)=X5(I,1)
8340    Y(I)=X5(I,2)
8350 NEXT I
8360 GO TO 2630
8370 DELETE X,Y,C1,C2
8380 DIM X(N6),Y(N6),C1(N6),C2(N6)
8390 N=N6
8400 O7=3
8410 FOR I=1 TO N
8420    X(I)=X6(I,1)
8430    Y(I)=X6(I,2)
8440 NEXT I
8450 GO TO 2630
8460 DELETE X,Y,C1,C2
8470 DIM X(N7),Y(N7),C1(N7),C2(N7)
8480 N=N7
8490 O7=4
8500 FOR I=1 TO N
8510    X(I)=X7(I,1)
8520    Y(I)=X7(I,2)
8530    O7=4
8540 NEXT I
8550 GO TO 2630
8560 DELETE X,Y,C1,C2
8570 DIM X(N8),Y(N8),C1(N8),C2(N8)
8580 N=N8
8590 O7=5
8600 FOR I=1 TO N
8610    X(I)=X8(I,1)
8620    Y(I)=X8(I,2)
8630 NEXT I
8640 GO TO 2630
8650 DELETE X,Y,C1,C2
8660 DIM X(N9),Y(N9),C1(N9),C2(N9)
8670 N=N9
8680 O7=6
8690 FOR I=1 TO N
8700    X(I)=X9(I,1)
8710    Y(I)=X9(I,2)
8720 NEXT I
8730 GO TO 2630
8740 END
50000 MOVE X5(1,1),X5(1,2)
50010 FOR I=1 TO N5
```

```
50020    DRAW X5(I,1),X5(I,2)
50030 NEXT I
50040 MOVE X6(1,1),X6(1,2)
50050 FOR I=1 TO N6
50060    DRAW X6(I,1),X6(I,2)
50070 NEXT I
50080 MOVE X7(1,1),X7(1,2)
50090 FOR I=1 TO N7
50100    DRAW X7(I,1),X7(I,2)
50110 NEXT I
50120 MOVE X8(1,1),X8(1,2)
50130 FOR I=1 TO N8
50140    DRAW X8(I,1),X8(I,2)
50150 NEXT I
50160 MOVE X9(1,1),X9(1,2)
50170 FOR I=1 TO N9
50180    DRAW X9(I,1),X9(I,2)
50190 NEXT I
50200 END
51000 REM CHANGE X5
51010 PAGE
51020 FOR I=1 TO N5
51030    PRINT USING "3D,2(6D)":I,X5(I,1),X5(I,2)
51040 NEXT I
51050 PRINT "WHICH ELEMENT ENTER ROW THE COL";
51055 PRINT "  ENTER 0 TO EXIT ";
51060 INPUT Row,Col
51065 IF Row=0 THEN 51200
51070 PRINT "ENTER CHANGE";
51080 INPUT Chg
51090 X5(Row,Col)=X5(Row,Col)+Chg
51100 GO TO 51050
51200 END
52000 REM CHANGE X6
52010 PAGE
52020 FOR I=1 TO N6
52030    PRINT USING "3D,2(6D)":I,X6(I,1),X6(I,2)
52040 NEXT I
52050 PRINT "WHICH ELEMENT ENTER ROW THE COL";
52055 PRINT "  ENTER 0 TO EXIT ";
52060 INPUT Row,Col
52065 IF Row=0 THEN 51200
52070 PRINT "ENTER CHANGE";
52080 INPUT Chg
52090 X6(Row,Col)=X6(Row,Col)+Chg
52100 GO TO 52050
53000 REM CHANGE X7
53010 PAGE
53020 FOR I=1 TO N7
53030    PRINT USING "3D,2(6D)":I,X7(I,1),X7(I,2)
53040 NEXT I
53050 PRINT "WHICH ELEMENT ENTER ROW THE COL";
53055 PRINT "  ENTER 0 TO EXIT ";
53060 INPUT Row,Col
53065 IF Row=0 THEN 51200
53070 PRINT "ENTER CHANGE";
53080 INPUT Chg
```

```
53090 X7(Row,Col)=X7(Row,Col)+Chg
53100 GO TO 53050
54000 REM CHANGE X8
54010 PAGE
54020 FOR I=1 TO N8
54030    PRINT USING "3D,2(6D)":I,X8(I,1),X8(I,2)
54040 NEXT I
54050 PRINT "WHICH ELEMENT ENTER ROW THE COL";
54055 PRINT "  ENTER 0 TO EXIT ";
54060 INPUT Row,Col
54065 IF Row=0 THEN 51200
54070 PRINT "ENTER CHANGE";
54080 INPUT Chg
54090 X8(Row,Col)=X8(Row,Col)+Chg
54100 GO TO 54050
55000 REM CHANGE X9
55010 PAGE
55020 FOR I=1 TO N9
55030    PRINT USING "3D,2(6D)":I,X9(I,1),X9(I,2)
55040 NEXT I
55050 PRINT "WHICH ELEMENT ENTER ROW THE COL";
55055 PRINT "  ENTER 0 TO EXIT ";
55060 INPUT Row,Col
55065 IF Row=0 THEN 51200
55070 PRINT "ENTER CHANGE";
55080 INPUT Chg
55090 X9(Row,Col)=X9(Row,Col)+Chg
55100 GO TO 55050
60000 REM PRINT X ON FOOT
60010 FOR I=1 TO N5
60020    MOVE @D:X5(I,1),X5(I,2)
60030    GOSUB 62000
60040 NEXT I
60050 FOR I=1 TO N6
60060    MOVE @D:X6(I,1),X6(I,2)
60070    GOSUB 62000
60080 NEXT I
60090 FOR I=1 TO N7
60100    MOVE @D:X7(I,1),X7(I,2)
60110    GOSUB 62000
60120 NEXT I
60130 FOR I=1 TO N8
60140    MOVE @D:X8(I,1),X8(I,2)
60150    GOSUB 62000
60160 NEXT I
60170 FOR I=1 TO N9
60180    MOVE @D:X9(I,1),X9(I,2)
60190    GOSUB 62000
60200 NEXT I
60210 END
62000 RDRAW @D:3,5
62010 RDRAW @D:-6,-10
62020 RMOVE @D:3,5
62030 RDRAW @D:-3,5
62040 RDRAW @D:6,-10
62050 RETURN
63000 FOR I=1 TO 6
```

```
63010    MOVE @D:X1(I),Y1(I)
63015    IF X1(I)=0 AND Y1(I)=0 THEN 63030
63020    GOSUB 63700
63030 NEXT I
63100 FOR I=1 TO 6
63110    MOVE @D:X2(I),Y2(I)
63115    IF X2(I)=0 AND Y2(I)=0 THEN 63130
63120    GOSUB 63700
63130 NEXT I
63200 FOR I=1 TO 6
63210    MOVE @D:X3(I),Y3(I)
63215    IF X3(I)=0 AND Y3(I)=0 THEN 63230
63220    GOSUB 63700
63230 NEXT I
63300 FOR I=1 TO 6
63310    MOVE @D:X4(I),Y4(I)
63315    IF X4(I)=0 AND Y4(I)=0 THEN 63330
63320    GOSUB 63700
63330 NEXT I
63400 FOR I=1 TO 6
63410    MOVE @D:H1(I),H2(I)
63415    IF H1(I)=0 AND H2(I)=0 THEN 63430
63420    GOSUB 63700
63430 NEXT I
63500 END
63700 RDRAW @D:1,5
63710 RDRAW @D:-2,-10
63720 RMOVE @D:1,5
63730 RDRAW @D:-1,5
63740 RDRAW @D:2,-10
63750 RETURN
63760 END
64000 PRINT "WHAT FILE FOR RETRIEVAL? ";
64005 INPUT B$
64008 DELETE X1,X2,X3,X4,X5,X6,X7,X8,X9,H1,H2,Y1,Y2,Y3,Y4
64009 DIM X1(6),X2(6),X3(6),X4(6),H1(6),H2(6),Y1(6),Y2(6),Y3(6),Y4(6)
64010 OPEN B$;1,"R",C$
64020 READ #1:N5,N6,N7,N8,N9,X1,X2,X3,X4,H1,Y1,Y2,Y3,Y4,H2
64030 DIM X5(N5,2),X6(N6,2),X7(N7,2),X8(N8,2),X9(N9,2)
64040 READ #1:X5,X6,X7,X8,X9
64050 PRINT "TENSION? ";
64060 INPUT P(2)
64070 END
65000 PRINT "WHAT FILE FOR STORAGE? ";
65005 INPUT B$
65006 CALL "FILE",0,B$,C$
65007 PRINT LEN(C$)
65008 IF LEN(C$)<>0 THEN 65020
65010 CREATE B$;1000,0
65020 OPEN B$;1,"F",C$
65030 WRITE #1:N5,N6,N7,N8,N9,X1,X2,X3,X4,H1,Y1,Y2,Y3,Y4,H2
65040 WRITE #1:X5,X6,X7,X8,X9
65060 END
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George, Charles W.; Johnson, Gregg M. 1990. Developing air tanker performance guidelines. Gen. Tech. Rep. INT-208. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 96 p.

Describes procedures for applying the measured flow history of water or fire retardant from an airtanker and, with the aid of a model (PATSIM), developing a guide for attaining optimum retardant distribution from a specific airplane and tanking system. Text and drawings are assembled into a sample guide for the Evergreen P2V-5 airplane.

KEWORDS: wildland fire, fire management, fire retardant, retardant patterns, retardant flow rates

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The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

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